



June 2021

# NAVY SHIPS

## Timely Actions Needed to Improve Planning and Develop Capabilities for Battle Damage Repair

Accessible Version



A Century of Non-Partisan Fact-Based Work

# GAO Highlights

Highlights of [GAO-21-246](#) a report to congressional committees

## Why GAO Did This Study

The ability to repair and maintain ships plays a critical role in sustaining Navy readiness. After the Cold War, the Navy divested many wartime ship repair capabilities. With the rise of great power competitors capable of producing high-end threats in warfare, the Navy must now be prepared to quickly salvage and repair damage to a modern fleet.

House Report 116-120, accompanying a bill for the National Defense Authorization Act for Fiscal Year 2020, included a provision for GAO to assess the Navy's efforts to identify and mitigate challenges in repairing battle-damaged ships during a great power conflict. GAO's report (1) discusses the challenges the Navy has identified in using its regular maintenance capability for battle damage repair, and (2) evaluates the extent to which the Navy has begun developing the battle damage repair capability it requires to prevail in a great power conflict. GAO reviewed relevant guidance and assessed reports on naval war games and other documentation to identify challenges that may impede the planning and repair of battle-damaged ships and efforts to improve the repair capability for a great power conflict.

## What GAO Recommends

GAO is making three recommendations, including that the Secretary of the Navy designate an organization to lead battle damage repair efforts and periodically assess and update ship vulnerability models to reflect the ship's mission-critical systems. The Navy partially concurred with these recommendations, which GAO continues to believe are warranted.

View [GAO-21-246](#). For more information, contact Diana Maurer at (202) 512-9627 or [MaurerD@gao.gov](mailto:MaurerD@gao.gov).

June 2021

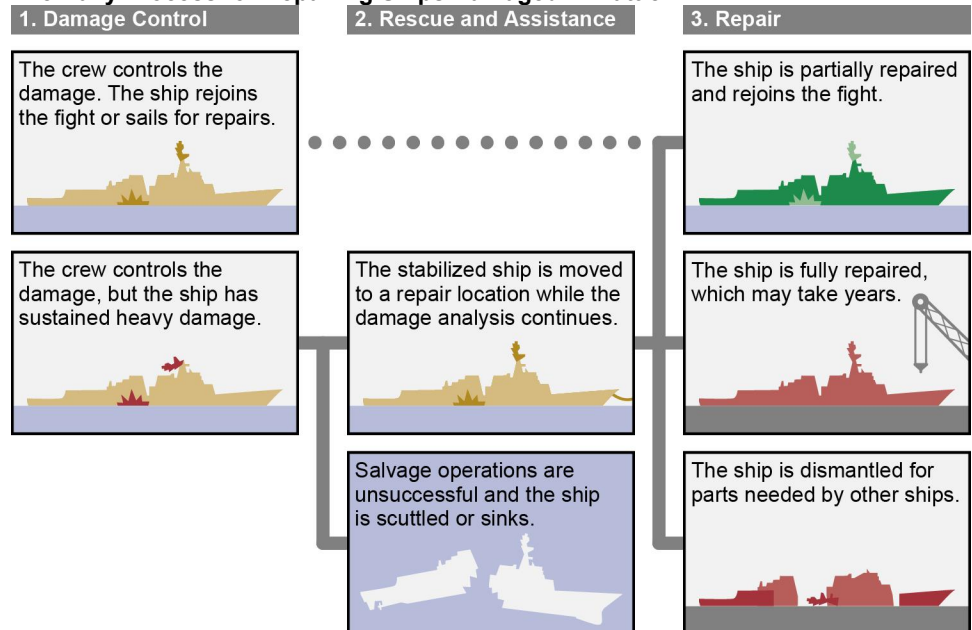
## NAVY SHIPS

### Timely Actions Needed to Improve Planning and Develop Capabilities for Battle Damage Repair

## What GAO Found

The Navy has identified several challenges with using its regular maintenance capability (which restores ships to fully operational status) to provide battle damage repairs during a great power conflict. Challenges include—the lack of established doctrine for battle damage repair, unclear command and control roles, and a shortage of repair capacity.

### The Navy Process for Repairing Ships Damaged in Battle



Source: GAO analysis of Department of Defense information. | GAO-21-246

### Text of The Navy Process for Repairing Ships Damaged in Battle

#### 1) Damage Control

- The crew controls the damage. The ship rejoins the fight or sails for repairs
- The crew controls the damage, but the ship has sustained heavy damage

#### 2) Rescue and Assistance

- The stabilized ship is moved to a repair location while the damage analysis continues
- Salvage operations are unsuccessful and the ship is scuttled or sinks.

### 3) Repair

- a) The ship is partially repaired and rejoins the fight.
- b) The ship is fully repaired which may take years.
- c) The ship is dismantled for parts needed by other ships.

The Navy is in the early stages of determining how it will provide battle damage repair during a great power conflict. Eight organizations are responsible for the Navy's 15 battle damage repair planning efforts, however the Navy has not designated an organization to lead and oversee these efforts. Without designated leadership, the Navy may be hindered in its efforts to address the many challenges it faces in sustaining its ships during a great power conflict.

The Navy develops ship vulnerability models during a ship's acquisition to estimate damage during a conflict. These models are also used to inform war games that refine operational approaches and train leaders on decision-making. However, the Navy does not update these models over a ship's decades-long service life to reflect changes to key systems that could affect model accuracy. As a result, it lacks quality data on ship mission-critical failure points to inform its analysis of battle damage repair needs. Without periodically assessing and updating its models to accurately reflect the ship's mission-critical systems, the Navy has limited its ability to assess and develop battle damage repair capabilities necessary to sustain ships in a conflict with a great power competitor.

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## Abbreviations

DOD	Department of Defense
MDSU	Mobile Diving and Salvage Units
NAVSEA	Naval Sea Systems Command
NSWC-CD	Naval Surface Warfare Center, Carderock Division
OPNAV N4	Office of the Chief of Naval Operations for Fleet Readiness and Logistics
SUPSALV	NAVSEA Office of the Supervisor of Salvage and Diving

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June 2, 2021

## Congressional Committees

The U.S. Navy's ability to repair and maintain its ships plays a critical role in sustaining readiness during both peace and times of conflict. The Navy has not needed to triage and repair multiple battle-damaged ships in quick succession since World War II. After the end of the Cold War, the Navy divested many of its wartime ship repair capabilities, and its ship maintenance capabilities have evolved to focus largely on supporting peacetime maintenance needs.<sup>1</sup> However, the rise of 21st century adversaries capable of producing high-end threats in warfare—referred to as great power competitors—revives the need for the Navy to reexamine its battle damage repair capability to ensure it is ready for potential conflict. The *2017 National Security Strategy* stressed the importance of the military developing capabilities that are able to counter the rise of great power competitors such as China and Russia.<sup>2</sup> Those capabilities include ship repair for maritime warfare in the modern era.

Modern warships have intricate electrical, radar, and computer systems that did not exist on World War II-era warships, making damage assessment and repair of modern ships significantly more complex. Our prior work has shown that the Navy has faced persistent challenges in conducting regular maintenance on its fleet during peacetime. Since 2015, we have issued several reports and testimonies examining Navy maintenance challenges, shipyard workforce and capital investment, ship crewing, scheduling, and force structure.<sup>3</sup> For example, in 2020 we reported that the Navy is frequently unable to complete its scheduled

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<sup>1</sup>For the purposes of this report, we refer to peacetime maintenance as regular maintenance capability.

<sup>2</sup>President of the United States, *National Security Strategy of the United States of America* (December 2017).

<sup>3</sup>See, e.g. GAO, *Navy Shipyards: Actions Needed to Address the Main Factors Causing Maintenance Delays for Aircraft Carriers and Submarines*, [GAO-20-588](#) (Washington, D.C.: Aug. 20, 2020). See also *Actions Needed to Address Maintenance Delays for Surface Ships Based Overseas*, [GAO-20-86](#) (Washington, D.C.: Feb. 26, 2020) and *Actions Needed to Address Costly Maintenance Delays Facing the Attack Submarine Fleet*, [GAO-19-229](#) (Washington, D.C.: Nov. 19, 2018). For an overview of related past recommendations and the Navy's steps to address them, see *Navy Maintenance: Persistent and Substantial Ship and Submarine Maintenance Delays Hinder Efforts to Rebuild Readiness*, [GAO-20-257T](#) (Washington, D.C.: Dec. 4, 2019).

maintenance on time and has incurred over 38,900 days of maintenance delay from fiscal years 2014 through 2020.<sup>4</sup> This equates to losing the operational availability of approximately 15 ships on average each year. Similarly, we reported that the Navy faced maintenance delays at shipyards overseas, with 3,475 more days of maintenance than planned from fiscal year 2014 through fiscal year 2018.<sup>5</sup> In light of ongoing shipyard challenges to keep up with regular maintenance demand, battle damage repairs may further exacerbate these challenges.

House Report 116-120, accompanying a bill for the National Defense Authorization Act for Fiscal Year 2020, included a provision for us to assess the Navy's efforts to identify and mitigate challenges in repairing battle-damaged ships during a great power conflict.<sup>6</sup> Our report (1) identifies the Navy's challenges in using its regular maintenance capability during a great power conflict, and (2) evaluates the extent to which the Navy has begun developing the battle damage repair capability it would require in the event of such conflict.

To address these objectives, we reviewed relevant laws, regulations, and Department of Defense (DOD) and Navy guidance that govern ship repair and maintenance. The Navy provided reports on naval war games and working group meetings that discuss battle damage repair capability for our review. We assessed reports on naval war games, working group briefings, and other documentation to identify (1) challenges that may impede the planning and repair of battle-damaged ships, and (2) efforts to improve the Navy's battle damage repair capability for a great power conflict. We also assessed these efforts against DOD's planning considerations framework outlined in Chairman of the Joint Chiefs of Staff Instruction 3010.02E, *Guidance for Developing and Implementing Joint Concepts* to understand the extent of the Navy's efforts to assess and develop its battle damage repair capabilities.<sup>7</sup> We reviewed reports, briefings, guidance, and other documentation and conducted interviews

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<sup>4</sup>Delays that prevent a ship from completing a maintenance period on time are measured in days of maintenance delay. GAO, *Navy and Marine Corps: Services Continue Efforts to Rebuild Readiness, but Recovery Will Take Years and Sustained Management Attention*, [GAO-21-225T](#) (Washington, D.C.: Dec. 2, 2020).

<sup>5</sup>[GAO-20-86](#).

<sup>6</sup>H. R. Rep. No. 116-120, at 93 (2019).

<sup>7</sup>Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3010.02E, *Guidance for Developing and Implementing Joint Concepts* (Aug. 17, 2016).

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with Navy officials to describe challenges to using the Navy's ship repair and maintenance capability to support battle damage repair needs.

We also found that two key principles of internal control, as outlined in *Standards for Internal Control in the Federal Government*, were significant to these objectives: (1) that management should establish an organizational structure, assign responsibility, and delegate authority to achieve the entity's objectives; and (2) that organizations should obtain and process quality information that supports their needs.<sup>8</sup> We assessed whether the Navy has clear roles and responsibilities for managing and overseeing battle damage repair planning. We also interviewed officials from across the Navy to discuss potential challenges associated with using the current maintenance capability to respond to battle-damaged ships and efforts to address these challenges. See appendix I for a list of the organizations we contacted over the course of this review.

We conducted this performance audit from December 2019 to June 2021 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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<sup>8</sup>GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: Sept. 10, 2014).

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## Background

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### The Navy's Battle Damage Repair Capability

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#### Battle Damage Repair during World War II

Between October 1941 and December 1942, in the midst of World War II, over 90 vessels were damaged or lost due to enemy action, of which 17 sustained damage or were lost during the Guadalcanal campaign alone. In the face of such a high rate of damage, the Navy needed to conduct repairs quickly to return many heavily damaged ships to combat.

The nationwide mobilization of the industrial base allowed the United States to respond aggressively to its wartime repair and rebuilding needs. As a notable example, in 1942, the U.S. Navy repaired the battle-damaged USS *Yorktown* in Pearl Harbor within 3 days and returned the ship to its fleet in time to support the Battle of Midway.

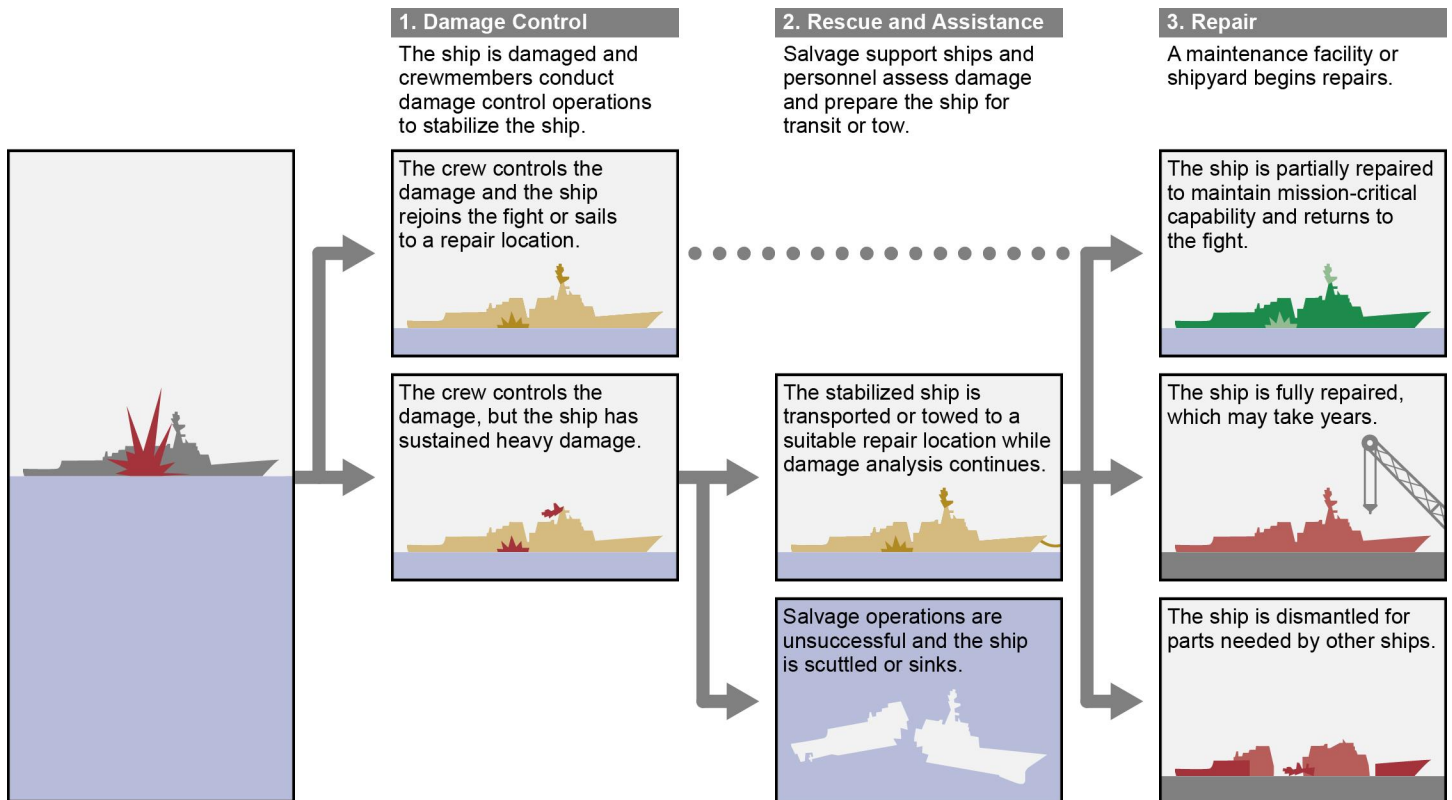
Source: GAO analysis of Navy Heritage and History Command documents. | [GAO-21-246](#)

Battle damage repairs are essential repairs that may be improvised and carried out rapidly in a hostile environment in order to return damaged or disabled equipment to temporary service. The Navy has not needed to triage and repair multiple battle-damaged ships in quick succession since World War II (see sidebar). As a result, the nation has divested much of the battle damage repair capability that it previously possessed by reducing the number of public shipyards and eliminating tenders and other vessels that specialize in ship repair. As such, any repairs to a ship damaged in battle today would largely draw on the Navy's regular maintenance capability, personnel, and resources.<sup>9</sup> A ship damaged—whether in battle or through a mishap at sea—follows a similar repair process. Specifically, appropriate personnel (1) control the damage to sustain the ship's ability to stay afloat (damage control), (2) assess critical damage and make temporary repairs to keep the ship afloat (rescue and assistance), and (3) continue damage assessment and ready the ship to make more permanent repairs (repair). See figure 1 for additional information. At each phase, the level of repair the ship receives would depend on the extent of the damage incurred, the ship's remaining capability, the time required to make repairs, and the need for the ship to rejoin the fight, among other factors.

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<sup>9</sup>The Navy's regular maintenance capability is the network of public and private shipyards, regional maintenance centers, and related support that the Navy uses to maintain ships. Maintenance includes all actions—inspection, testing, servicing, repair, and rebuilding, among others—taken to ensure a ship may be continuously used at its original or designed capacity and efficiently for its intended purpose.

**Figure 1: The Navy Process for Repairing Ships Damaged in Battle**



Source: GAO analysis of Department of Defense information. | GAO-21-246

**Text of Figure 1: The Navy Process for Repairing Ships Damaged in Battle**

**1) Damage Control**

- a) The crew controls the damage. The ship rejoins the fight or sails for repairs
- b) The crew controls the damage, but the ship has sustained heavy damage

**2) Rescue and Assistance**

- a) The stabilized ship is moved to a repair location while the damage analysis continues
- b) Salvage operations are unsuccessful and the ship is scuttled or sinks.

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3) Repair

- a) The ship is partially repaired and rejoins the fight.
- b) The ship is fully repaired which may take years.
- c) The ship is dismantled for parts needed by other ships.

## Damage Control

After a ship sustains damage, its crewmembers conduct damage control and fire protection operations to mitigate additional damage to the ship. These efforts may range from pumping water from flooded compartments to extinguishing any fires that may have started because of the damage. Damage control operations stabilize the ship until it can be assisted by salvage crews (see text box).

### **USS *Samuel B. Roberts* Mine Strike**



On April 14, 1988, the USS *Samuel B. Roberts* struck an Iranian moored contact mine in the Arabian Gulf. The mine inflicted serious damage to the ship, ripping open its keel—the ship's structural backbone—and blowing a 21-foot-hole into its left side, causing the ship to flood with over 2,000 tons of water in two key areas and starting a major fire. The mine also damaged three of the four diesel engines, leading to a brief loss of power. Applying their training for this

type of scenario, the ship's sailors quickly worked to jump-start the fourth engine to restore its power and pumps, shore up the flooding, and stabilize the cracked structure with cables. After 7 hours, the crew had stabilized the ship. On April 17, the Navy towed the ship to Dubai to be dry docked for temporary repairs.

After several months of making temporary repairs and arranging a contract for a private company to tow the damaged vessel, a Dutch heavy-lift ship transported the USS *Samuel B. Roberts* from the Arabian Gulf to a dry dock in Maine for additional repairs. The repairs were completed and the ship returned to service on October 16, 1989, over 18 months after the explosion.

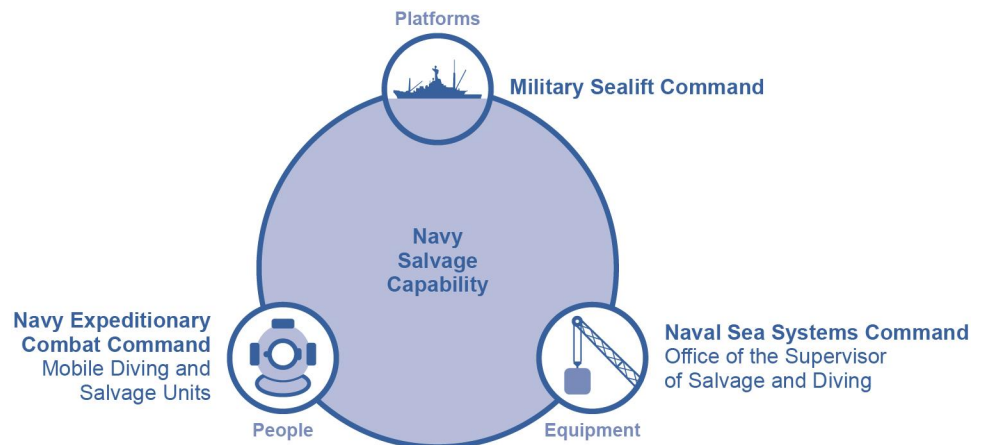
Source: GAO analysis of Navy Heritage and History Command documents; U.S. Navy/Photographer's Mate First Class Chuck Mussi. | [GAO-12-246](#)

## Rescue and Assistance

Rescue and assistance operations may range from routine and emergency vessel tows, to underwater repairs at shallow depths, to more demanding salvage missions such as refloating sunken or stranded ships, raising submarines, clearing wrecks from obstructed waterways, responding to oil pollution, and recovering objects from the deepest depths of the oceans. In response to battle damage, salvage operations prevent the loss of a ship from fire and flooding and make the vessel stable enough to return to full or partial service with its combat group. Three organizations comprise the Navy's salvage capability: Navy Expeditionary Combat Command Mobile Diving and Salvage Units (MDSU), the Naval Sea Systems Command Office of the Supervisor of

Salvage and Diving (SUPSALV), and the Military Sealift Command (see fig. 2). An effective salvage response requires coordination among these three Navy commands.

**Figure 2: Navy Organizations That Support Salvage Capability**



Source: GAO analysis of Department of the Navy information. | GAO-21-246

- Mobile Diving and Salvage Units (MDSU):** These units consist of Navy divers that conduct underwater salvage operations such as recovering ships, removing objects that obstruct ports, search and recovery, and diving operations. The majority of the fleet's salvage capability comes from two units: MDSU One and MDSU Two. MDSU One headquarters and six companies are located in Pearl Harbor, Hawaii and two companies are located in San Diego, California. MDSU Two consists of a headquarters element, six 17-personnel companies and one eight-personnel area search platoon located in Little Creek, Virginia. MDSUs are under the administrative control of the Navy Expeditionary Combat Command and under the operational control of U.S. Fleet Forces in Norfolk, Virginia and U.S. Pacific Fleet in Pearl Harbor, Hawaii.
- Office of the Supervisor of Salvage and Diving (SUPSALV):** This organization provides salvage facilities for public and private vessels, technical assistance during salvage and recovery operations, and private contract management for additional salvage and rescue ships and fleet ocean tugs if government-owned platforms are not available. SUPSALV also manages emergency ship salvage materials, which support missions of underwater operations, ocean engineering, diving, and oil and hazardous spill response, and maintains them in ready condition. Emergency ship salvage materials are carried by Military

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Sealift Command rescue and salvage ships for ready application when needed.

- **Military Sealift Command:** This command maintains and operates three fleet ocean tugs and two rescue and salvage ships.<sup>10</sup> Fleet ocean tugs provide the Navy fleet with towing services and can tow ships as large as an aircraft carrier. When carrying specialized equipment, fleet ocean tugs assist in the recovery of downed aircraft, stranded or grounded ships, and submarine rescue operations. Rescue and salvage ships recover objects from the sea, tow stranded vessels, and provide firefighting assistance. Like fleet ocean tugs, rescue and salvage ships are able to lift objects as heavy as downed aircraft and stranded or grounded ships. Rescue and salvage ships deploy with salvage forces provided by MDSU divers to conduct rescue and salvage operations.<sup>11</sup>

### Repair

After rescue and assistance operations have been completed, a battle damaged ship would travel or be transported to a longer-term repair facility, such as a shipyard or regional maintenance center, where it would undergo any remaining repairs. The Navy's battle damage repair capability draws on its current ship maintenance and repair infrastructure for both planned and unplanned repairs. Naval Sea Systems Command (NAVSEA) engineers, builds, buys and maintains the Navy's ships and submarines and their combat systems. NAVSEA manages and directs the development, implementation, operational maintenance, and improvement of all aspects of each ship's maintenance and material management system throughout the Navy. This includes managing and overseeing the public shipyards. During normal operations, the Navy supports different types of ship repair and maintenance: planned

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<sup>10</sup>The three fleet ocean tugs currently in service are the USNS *Apache*, USNS *Catawba*, and USNS *Sioux*. In addition to the two rescue and salvage ships (USNS *Grasp* and USNS *Salvor*) currently in service, two additional ships (USNS *Safeguard* and USNS *Grapple*) are out of service and in reserve status since 2016. The Navy plans to acquire a new class of towing, salvage, and rescue ship—the *T-ATS Navajo class*—to replace mission requirements for both fleet ocean tugs and rescue and salvage ships. The first ship of that class is scheduled for delivery to the fleet in fiscal year 2022. The Navy has the option to purchase up to eight *Navajo-class* ships, although as of 2020 it has begun construction on just five.

<sup>11</sup>For the purposes of this report, we refer to fleet ocean tugs and rescue and salvage ships collectively as salvage support ships.

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maintenance, such as lifecycle repairs conducted at a shipyard or voyage repairs, and unplanned maintenance, such as emergent repairs.<sup>12</sup>

Unlike during regular maintenance, emergent repairs may require damage control and salvage operations immediately following the incident that triggered the need for such repairs. Emergent repairs such as those in response to the USS *Fitzgerald* and USS *John S. McCain* collisions in 2017 more closely mirror a battle damage repair process (see fig. 3).<sup>13</sup>

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<sup>12</sup>Planned maintenance periods are scheduled to accomplish industrial, depot-level maintenance and modernization—work that cannot be conducted by ship's crews or goes beyond fleet capabilities. These maintenance periods can last 6 months or longer and the Navy generally schedules them every 2 to 3 years throughout a ship's service life. They can be conducted at public or private shipyards, or at regional maintenance centers operated by the Navy. Voyage repair maintenance periods are maintenance occurring outside of the United States focused solely on correcting mission- or safety-essential maintenance necessary for a ship to deploy or continue its deployment. Emergent repairs are conducted with little or no notice to restore a failed mission-essential system or component, and are often the result of a mishap at sea, such as a collision with another vessel, a ship run aground, or a fire.

<sup>13</sup>In June 2017, the USS *Fitzgerald* collided with a merchant vessel off the coast of Japan. This collision resulted in the loss of seven sailors. Navy tugboats towed the *Fitzgerald* to Fleet Activities Yokosuka, Japan, where it received temporary repairs. Later, the MV *Transshelf* transported the ship to Ingalls Shipyard in Pascagoula, Mississippi where it received the remainder of its repairs. In August 2017, the USS *John S. McCain* collided with an oil tanker near Singapore. This collision resulted in the loss of 10 sailors and injury to five more. Initially, the ship was able to make it on its own power to Changi Naval Base in Singapore. Later, it was transported by a private contractor to Fleet Activities Yokosuka in Japan, where it was repaired from August 2017 to October 2019. Both collisions resulted in hundreds of millions of dollars in damage.

**Figure 3: USS *John S. McCain* Transported aboard the MV *Treasure* after Its 2017 Collision**



Source: U.S. Navy/Capt. Keith Lehnhardt. | GAO-21-246

Although battle damage repair leverages the Navy's regular maintenance capability to perform repairs, environmental conditions of war present unique considerations that are not present during peacetime:

- **External threat:** Battle damage repair likely would take place in a combat zone where the ship, salvage operations, and potential repair facilities would be at risk of attack from a great power competitor.
- **Time constraints:** To meet operational needs during a great power conflict, Navy planners expect they would need to make repairs to the ship as quickly as possible for the ship to rejoin its combat group or retreat from the combat zone. While shipyard repairs can take months or years, a fleet engaged in conflict with a great power competitor may not be able to wait for repairs to a battle-damaged ship.
- **Scale of damage:** In a great power competition, multiple ships may be damaged at the same time, requiring the Navy to conduct multiple repair efforts at once. Fleet commanders would need to weigh

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mission-critical considerations in deciding which ships to repair quickly in-theater and which ships to send out of the conflict zone for long-term repairs. In some cases, mission needs might even require a damaged ship to be cannibalized (i.e., stripped for parts for use on another ship), scuttled (i.e., sunk deliberately), or returned to the fight still damaged.

- **Proximity of resources:** According to officials, the Navy would need to rely on resources (e.g., salvage support ships, spare parts, and personnel) positioned closer to the conflict in order to sufficiently restore the ship to mission-critical capability and return it to the fleet. Depending on the nature of the conflict, the Navy may not be able to rely on additional ships to replace damaged ones—making the need for battle damage repair capability all the more important.

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## DOD Strategy and Navy Concept of Operations to Address Great Power Competitors

The *2017 National Security Strategy* and *2018 National Defense Strategy* both emphasize the need for the United States to prepare for great power competition.<sup>14</sup> The *National Security Strategy* calls for DOD to develop new operational concepts and capabilities to win a war without assured dominance at sea. The *National Defense Strategy* calls for resilient and agile logistics—which includes battle damage repair—and for directing investments that prioritize prepositioned supplies, strategic mobility assets, and maintenance to ensure logistical support is sustained throughout conflict with a great power competitor.

In response to the shift in focus to great power competitors, the Navy developed two new operational concepts:

- **Distributed Maritime Operations.** This is the Navy's fleet-centric warfighting approach to maritime conflict in an era of great power competition. To counter the challenges posed by great power competitors (such as long-range precision munitions), the Navy plans to use distributed forces—ships operating in more widely dispersed formations that complicate enemy targeting—to improve the Navy's lethality and agility in contested maritime environments. The concept

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<sup>14</sup>President of the United States, *National Security Strategy of the United States of America* (December 2017); Department of Defense, *Summary of the 2018 National Defense Strategy of the United States of America* (2018).

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envisioning a distributed force that is more survivable and capable in a contested environment.

- **Operational Logistics in a Contested Maritime Environment.** This concept anticipates that a more widely-dispersed fleet will expand the Navy's need for logistical support, including battle damage repair. This concept identifies existing and projected logistical gaps to supporting a more distributed fleet and directs the Navy to develop new capabilities, capacities, and methods to address these gaps. According to the concept, the U.S. Navy will likely suffer increased damage in a contested maritime environment that will drive demand for expeditionary maintenance and salvage capabilities—meaning away from established shipyards and closer to the conflict. Further, this concept encourages logistics planners to reassess operational planning and assumptions regarding ship battle damage, repair, and the availability of commercial and military salvage operations.

In December 2018, the Chief of Naval Operations released *A Design for Maintaining Maritime Superiority*, which provides a framework to guide Navy actions and investments.<sup>15</sup> The document signals Navy leadership's growing recognition of the need for improved logistics concepts and capabilities. The document identifies as a priority area an effort to posture logistics capability ashore and at sea in ways that allow the fleet to operate globally and at a pace that can be sustained over time. Assessment and development of options for improved ability to perform repairs is part of the priority effort.

In December 2020, Marine Corps, Navy, and Coast Guard released *Advantage at Sea: Prevailing with Integrated All-Domain Naval Power*—a tri-service maritime strategy aimed at preparing these services to prevail in day-to-day competition, pre-conflict crisis, and conflict with great power competitors.<sup>16</sup> The strategy directs the Marine Corps, Navy, and Coast Guard to generate resilient and adaptable logistics—which includes battle damage repair—to sustain forces while under continuous multi-domain attack. In response to this strategy, the Chief of Naval Operations issued *Transforming Naval Logistics for Great Power Competition* in January 2021 to provide strategic guidance for effectively sustaining naval forces.

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<sup>15</sup> Chief of Naval Operations, *A Design for Maintaining Maritime Superiority, Version 2.0* (December 2018).

<sup>16</sup> United States Marine Corps, Navy, and Coast Guard, *Advantage at Sea: Prevailing with Integrated All-Domain Naval Power* (December 2020).

The document outlines elements of transformation required to sustain naval forces during a great power competition.<sup>17</sup>

## The Navy's Process for Developing Operational Concepts

When the Navy addresses a specific operational challenge, it first develops a concept. A concept is an expression of how operations might be conducted—a visualization of future operations that describes how warfighters, using military art and science, might employ capabilities to meet future challenges and exploit future opportunities. According to Navy guidance, concepts must have a purpose, timeframe, and defined military problem, as well as include solutions to that problem. Solutions should include approaches for how operations may be conducted, describe the potential end states for solving the problem, and describe the capabilities needed to implement the concept.<sup>18</sup>

Required warfighting capabilities do not necessarily translate into a need for new equipment or acquisitions. When a military service requires new or additional capabilities not associated with a new defense acquisition program, it can assess its capability gap through DOD's planning considerations framework (see table 1). This framework is intended to ensure that a military service has considered existing resources before turning to acquisition to solve a given problem. For example, ship repair capabilities could be enhanced through additional or modified training, creating or reorganizing units, or increasing staffing rather than by acquiring a new capability.

**Table 1: DOD Planning Considerations Framework**

Planning consideration	Description
Doctrine	The documents that describe how an organization plans to address a given problem
Organization	How an organization will structure and organize its units to address a given problem
Training	How an organization will teach its personnel to address a given problem
Materiel	The supplies an organization will use to address a given problem
Leadership	Outlines who is in control—and what is expected of them—as an organization addresses a given problem

<sup>17</sup>Chief of Naval Operations, *Transforming Naval Logistics for Great Power Competition Version 1.0*, (January 2021) (hereafter CNO, *Transforming Naval Logistics*).

<sup>18</sup>Chief of Naval Operations Instruction 5401.9A, *Navy Concept Generation and Concept Development* Program (June 24, 2014). Capabilities are any ability available to a service conducting military operations; the ability to launch aircraft at sea or conduct battle damage repair are both examples of capabilities.

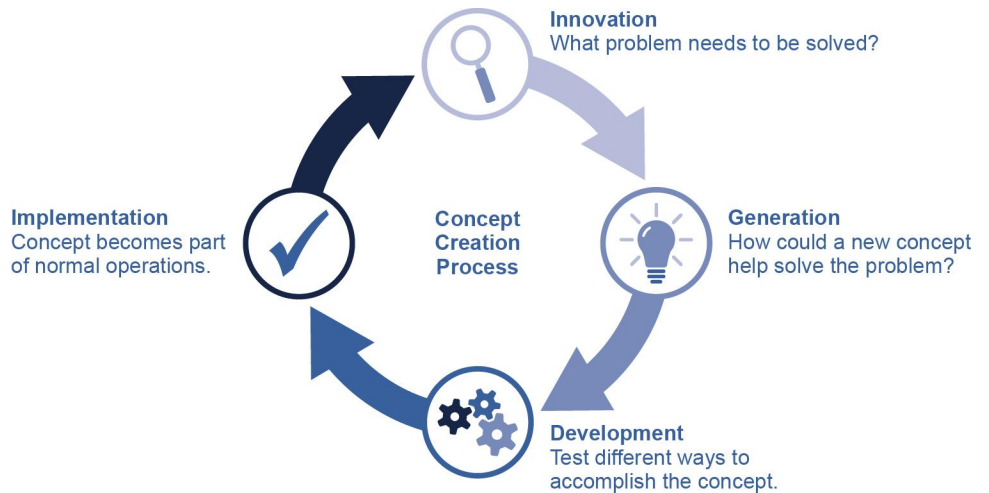
Planning consideration	Description
Personnel	The individuals with specific skills in an organization who will address a given problem
Facilities	The places where an organization will address a given problem

Source: GAO analysis of Department of Defense (DOD) guidance. | GAO-21-246

According to Chairman of the Joint Chiefs of Staff Instruction 3010.02E, *Guidance for Developing and Implementing Joint Concepts*, the elements of this framework are interrelated, and adjustments made to one element can require changes to others.<sup>19</sup> For example, a change in doctrine may require an organization that provides the capability to change how it trains, the materiel it uses, and the personnel or facilities it requires. Similarly, limitations in one area—such as personnel or facilities—can necessitate changes to doctrine or the training and materiel support provided to overcome these limitations. As such, using the planning considerations framework can be an iterative process.

The Navy's process for developing new concepts includes an assessment using the planning considerations framework and has four phases, as shown in figure 4.

**Figure 4: The Navy's Concept Development Process**



Source: GAO analysis of Navy guidance. | GAO-21-246

- **Innovation.** This phase begins with defining military problems and looking for emerging opportunities that can contribute to addressing them.

<sup>19</sup>CJCSI 3010.02E.

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- **Generation.** In this phase, a Navy component drafts white papers that summarize the concept and seeks approval to begin developing the concept. Primarily, this involves working with subject matter experts across the Navy to develop an action plan to address the concept. The plan is then sent to the Chief of Naval Operations for approval.
  - **Development.** In this phase, concept action plan tasks are assigned to appropriate resource sponsors and offices of primary responsibility for further development. Resource sponsors and responsible offices lead development of emerging capabilities and inform the Director, Navy Staff when a validated solution is ready for entry into the planning, programming, and budgeting process.
  - **Implementation.** During this phase, validated emerging capabilities transition from non-acquisition development to full acquisition products and are prepared for delivery to the fleet. Non-materiel solutions are assessed and implemented where appropriate across the planning considerations.

According to Navy guidance, the Navy's concept generation program takes a collaborative approach intended to create innovative concepts addressing near and far term challenges.

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## The Navy Has Identified Challenges to Using Current Repair Capability during a Great Power Conflict

The Navy has identified challenges—ranging across DOD's planning considerations, as shown in table 2 below—to using its current repair capability during a great power conflict.

**Table 2: Navy-Identified Challenges in Adapting Its Current Repair Capability for Battle Damage Repair, by Planning Consideration**

Planning consideration	Challenge
Doctrine	<ul style="list-style-type: none"> <li>Lack of established doctrine for battle damage repair</li> </ul>
Organization	<ul style="list-style-type: none"> <li>Lack of clear roles and responsibilities for organizations and units involved in assessing, developing, and conducting battle damage repair</li> </ul>
Training	<ul style="list-style-type: none"> <li>Reliance on maintenance contractors to provide wartime support reduces the skills of sailors for battle damage repair</li> <li>Lack of logistics-focused war games to refine operational concepts and train leaders on battle damage repair decision-making</li> </ul>
Materiel	<ul style="list-style-type: none"> <li>Reliance on contracted salvage support ships to provide support during a great power conflict</li> <li>Timely provision of spare parts needed for battle damage repair</li> </ul>
Leadership	<ul style="list-style-type: none"> <li>Unclear command and control responsibilities for battle damage repair decision-making during a great power conflict</li> </ul>
Personnel	<ul style="list-style-type: none"> <li>Reliance on civilian maintenance experts to provide battle damage repair capability in combat zones</li> </ul>
Facilities	<ul style="list-style-type: none"> <li>Regular maintenance capability already operating at or above capacity</li> <li>Unknown or unreliable availability of foreign ports</li> </ul>

Source: GAO analysis of Department of Defense information. | GAO-21-246

These challenges reflect both the difficulties that the Navy anticipates will accompany a great power competition, as well as perennial issues within the Navy.

- ***Lack of established doctrine for battle damage repair.*** The Navy does not have updated doctrine, tactics, techniques, and procedures that reflect the demands for battle damage repair during a great power conflict. In part, this is because the Navy has not needed to do such repairs at scale during a conflict in decades. (For more information on Navy efforts to update its doctrine, see appendix II).
- ***Lack of clear roles and responsibilities.*** Officials from multiple organizations in the Navy's regular maintenance functions, salvage community, and the fleets have responsibilities within the battle damage repair process and told us that the roles and responsibilities for assessing, developing, and conducting battle damage repair are not always clear. We discuss this in more detail later in this report.
- ***Reliance on maintenance contractors.*** The Navy generally contracts with private shipyards to conduct complex maintenance on non-nuclear ships. As a result, officials have raised concerns that sailors may not be adequately trained to conduct certain repairs if a ship is damaged during conflict. For example, Navy officials noted that training for sailors often focuses on the replacement of damaged

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parts, rather than repairing those parts. While replacement may be an appropriate solution in an environment where parts are readily available, Navy officials raised concerns that it might be problematic in a contested environment with vulnerable supply lines.

- *Lack of logistics-focused war games.* U.S. Naval War College officials stated that until 2019, the fleets generally did not evaluate logistical support in war games to simulate and refine operational approaches for battle damage repair operations or challenge war game assumptions concerning available salvage resources. They noted that this made it difficult to test assumptions and decision-making regarding logistics. However, in 2019, the Naval War College hosted the first logistics-focused war game that included battle damage repair elements, and another war game in 2020 included salvage organizations. A third war game focused on at-sea repair was conducted in May 2021.
- *Reliance on contracted salvage support ships.* Navy officials stated that the Navy relies on contracts for private-sector salvage ships and repair technicians to supplement its own salvage fleet. However, officials have raised concerns that private salvage companies may be unable or unwilling to support battle damage repair efforts during conflict with a great power competitor, due to safety concerns.
- *Parts needed for battle damage repair.* Navy officials have stated that they are not certain that the Navy has the right parts and materials ready for a great power competition. While the Navy does have battle spares, officials noted that spare parts acquisition is handled by independent program offices and may not reflect the most likely types of damage that could be expected during a great power competition.<sup>20</sup> In addition, the short time frames expected during battle damage repair could make the availability of parts even more critical. We discuss this in more detail later in this report.
- *Unclear command and control responsibilities.* The Navy lacks clear command and control responsibilities to execute battle damage repair decisions. For example, Navy officials we spoke with stated that it is not always clear who would be in control of a given portion of a battle damage repair response. We discuss this in more detail later in this report.

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<sup>20</sup>Navy officials told us this is because the battle spares programs are focused on parts that have long production times, not necessarily those most likely to suffer damage in an attack.

- *Reliance on civilian maintenance experts.* Navy officials noted that the Navy relies on civilian maintenance personnel stationed in the United States, who may not be willing or able to support battle damage repair overseas. For example, officials from multiple Navy organizations stated a concern that, in the event of a great power conflict, civilians may be unwilling or unable to enter a combat zone because the terms of their employment may not require them to conduct repairs in such an environment.
- *Regular maintenance capability is already operating at or above capacity.* The Navy is operating its regular maintenance operations at nearly full capacity and with limited ability to surge to meet sudden needs. Specifically, our prior work has shown that the Navy's maintenance process cannot keep up with the Navy's present needs.<sup>21</sup> Given its current challenges, the Navy would likely have difficulty meeting any further increase in demand that would result from battle damage sustained during a great power conflict. Since 2015, we have made a number of recommendations to the Navy to enhance its maintenance facilities and processes.<sup>22</sup> In 2018, the Navy created the Ship Infrastructure Optimization program office (PMS 555)—a dedicated office responsible for managing and executing the improvements at the Navy public shipyards designed to expand their efficiency and capacity, but the Navy projects that implementing these improvements will take decades.
- *Unknown or unreliable availability of foreign ports.* Navy officials stated that some overseas repair locations—such as foreign ports—may not be viable during great power conflict as areas that are currently safe for repairs come under the threat of attack or seek to avoid becoming involved for political reasons.

Although the Navy faces challenges in a number of areas, it is limited in its ability to address them at this time because of its ongoing work to develop battle damage repair doctrine. Specifically, the Navy is hampered in its efforts to assess its civilian repair workforce, contracted salvage ships, and needed foreign ports without first developing doctrine that

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<sup>21</sup>See, for example, GAO, *Naval Shipyards: Actions Needed to Improve Poor Conditions that Affect Operations*, [GAO-17-548](#) (Washington, D.C.: Sept. 12, 2017); [GAO-20-257T](#); and [GAO-20-588](#).

<sup>22</sup>For more, see "Appendix I: Implementation Status of Prior GAO Recommendations Related to Ship and Submarine Maintenance" in [GAO-20-257T](#).

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governs how it will conduct battle damage repair for a great power conflict.

The Navy is in the early stages of developing battle damage repair concepts, which could lead to updated requirements to reflect the demands of a conflict with a great power competitor. For example, U.S. Pacific Fleet began developing the Ship Wartime Repair and Maintenance concept in 2019 and finalized the concept in April 2021. This concept describes the people, parts, and processes necessary to provide in-theater ship and submarine maintenance and repair to sustain the fleet during contingency operations. In addition, U.S. Fleet Forces Command began developing the Expeditionary At-Sea Repair concept in 2019 and anticipates the concept will be completed in fiscal year 2022. Both concepts are expected to outline capabilities required to support repair operations to ships while forward-deployed at sea. According to Navy officials, these concepts will also form the basis for analytical efforts to assess and address the other planning factors. For these reasons we are not making recommendations at this time to address the Navy's doctrine and related challenges, but we will continue to monitor progress on these efforts.

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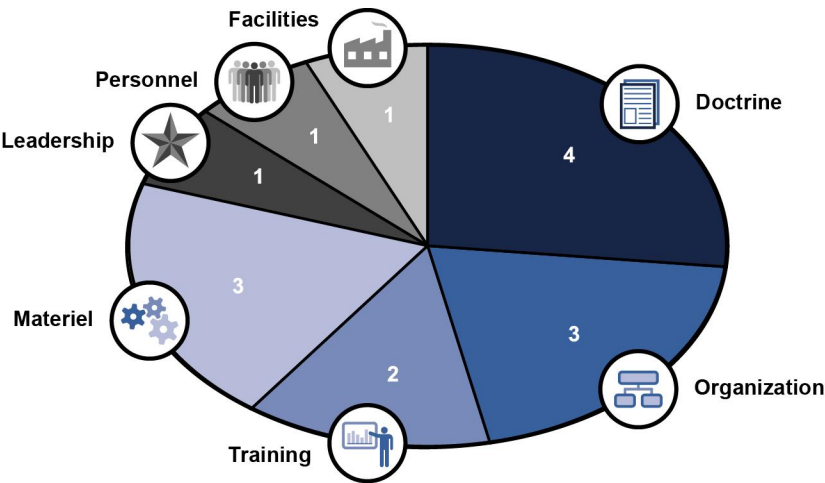
## The Navy Has Begun Developing Battle Damage Repair Capabilities, but Lacks Needed Guidance and Quality Data on Ship Vulnerability

The Navy is developing capability options and is in the early stages of determining how it will provide battle damage repair during a great power conflict. We identified 15 Navy-led battle damage repair planning efforts. However, the Navy has not formally identified an organization to coordinate these multiple efforts, thereby avoiding overlap and ensuring the efforts collectively produce the required capability needed to prevail during a great power conflict. In addition, the Navy lacks quality data on the vulnerability of its ships to inform efforts to analyze battle damage repair needs.

## The Navy Has Initiated Efforts to Update Its Approach and Capabilities for Battle Damage Repair

We identified 15 efforts the Navy has initiated to address various battle damage repair challenges. These efforts range across DOD’s planning considerations, as shown in figure 5.

**Figure 5: Number of Navy Efforts to Improve Battle Damage Repair, Grouped by DOD Planning Consideration**



Source: GAO analysis of Department of Defense information. | GAO-21-246

**Data table for Figure 5: Number of Navy Efforts to Improve Battle Damage Repair, Grouped by DOD Planning Consideration**

Doctrine	Organization	Training	Materiel	Leadership	Personnel	Facilities
4	3	2	3	1	1	1

Note: DOD planning considerations are described in Chairman of the Joint Chiefs of Staff 3010.02E, *Guidance for Developing and Implementing Joint Concepts* (Aug. 17, 2016) and applied to the Navy’s concept development process via Office of the Chief of Naval Operations Instruction 5401.9A, *Navy Concept Generation and Concept Development Program* (June 24, 2014).

More than half of the Navy’s battle damage repair efforts are in early developmental stages. For example, the oldest effort to improve battle damage repair we identified was the Salvage Executive Steering Committee, which is a working group of all Navy organizations involved with the salvage process. That group began in its current form in 2014, but had only been meeting once every other year, though officials have said the group now meets annually. As shown in figure 6, most of the other efforts were initiated starting in 2018 or later as individuals and

organizations within the Navy saw disconnects between the focus on great power competition described in the *National Security Strategy* and the Navy's ability to conduct effective battle damage repair.

**Figure 6: Timeline of Navy Efforts to Address Battle Damage Repair Challenges**



Source: GAO analysis of Department of the Navy information. | GAO-21-246

**Timeline of Figure 6: Timeline of Navy Efforts to Address Battle Damage Repair Challenges**

- 2014: Salvage Executive Steering Committee
- 2016: Navy Afloat Maintenance Training Strategy
- 2017
  - AEGIS Emergent Response Project

- Operational Logistics in a Contested Environment
- 2018
  - Logistics Warfare Improvement Program
  - Expeditionary Port Damage Repair Concept
  - Wartime Acquisition Support Plan
- 2019
  - First Logistics-Only War Game
  - Naval Engineering Sustainment Technology Team
  - Expeditionary At-Sea Repair Concept
  - Naval Sea Systems Command 05T Technology Integration Team
- 2020
  - Surface Team 1 Working Group
  - Mobile Logistics Campaign Plan
  - Repair Cross Functional Team
- 2021: Ship Wartime Repair and Maintenance Concept

Source: Source: GAO analysis of Department of the Navy information. | GAO-21-246

For additional information about the Navy’s specific challenges and efforts undertaken by its organizations to improve battle damage repair, see appendix II.

Eight Navy Organizations Are Responsible for Efforts to Improve Battle Damage Repair Planning

Eight Navy organizations are responsible for 15 efforts to improve battle damage repair planning without clear leadership and oversight to ensure these efforts ultimately produce the battle damage repair capability needed to prevail in a great power conflict (see table 3).

Table 3: Organizations Responsible for 15 Efforts to Improve Navy Battle Damage Repair Planning

Lead organization	Effort
Office of the Chief of Naval Operations	• Operational Logistics in a Contested Environment concept
	• Repair Cross Functional Team

Lead organization	Effort
Assistant Secretary of the Navy for Research, Development, and Acquisition	<ul style="list-style-type: none"> <li>• Wartime Acquisition Support Plan</li> </ul>
Naval Sea Systems Command (NAVSEA) <sup>a</sup>	<ul style="list-style-type: none"> <li>• Naval Engineering Sustainment Technology Team</li> <li>• 05T Technology Integration Team</li> <li>• Salvage Executive Steering Committee</li> <li>• Aegis Emergent Response Project</li> <li>• Navy Afloat Maintenance Training Strategy</li> <li>• Surface Team 1 Working Group</li> </ul>
Commander, Pacific Fleet	<ul style="list-style-type: none"> <li>• Ship Wartime Repair and Maintenance</li> <li>• Mobile Logistics Campaign Plan</li> </ul>
Military Sealift Command	<ul style="list-style-type: none"> <li>• Logistics Warfare Improvement Program</li> </ul>
Expeditionary Warfighting Development Command	<ul style="list-style-type: none"> <li>• <i>Expeditionary Port Damage Repair</i> concept</li> </ul>
U.S. Naval War College	<ul style="list-style-type: none"> <li>• Logistics-centered war games</li> </ul>
U.S. Fleet Forces Command	<ul style="list-style-type: none"> <li>• <i>Expeditionary At-Sea Repair</i> concept</li> </ul>

Source: GAO analysis of Department of the Navy information. | GAO-21-246

<sup>a</sup>Several NAVSEA offices contribute to these improvement efforts, including the Office of the Director of Ocean Engineering Supervisor of Salvage and Diving (SUPSALV); Commander, Navy Regional Maintenance Center; Naval Systems Engineering Directorate, Technology Office; and Naval Surface Warfare Center.

These efforts have all begun to examine various aspects of the Navy's battle damage repair capability, though some are more relevant than others. For example, the Expeditionary At-Sea Repair concept of operations explores new and existing capability that can provide battle damage assessment and repair at sea during a conflict with a great power competitor. Meanwhile, the Expeditionary Port Damage Repair concept is focused primarily on developing concepts to describe the Navy's plans for repairing damaged ports and only connects to battle damage repair insofar as those ports may be required to conduct emergency ship repairs.

The efforts also take different forms. Some are working groups—such as the efforts underway by the Repair Cross Functional Team, Surface Team 1 working group, and the Salvage Executive Steering Committee—while other efforts involve developing technology, creating concepts and doctrine, or improving training. In addition, because these efforts were created at different times and within different organizations, some organizations worked on similar concepts of operations or pursued solutions already developed by other organizations.

The Navy has recognized the need to improve its battle damage repair capability, but its efforts to do so have not been as effective as they could have been because it has not designated an organization with the

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appropriate authority to lead its efforts. Navy officials attributed the lack of a designated organization to lead efforts to develop and assess its battle damage repair capabilities to the relatively recent strategic shift in focus to great power competition. Several of the Navy's battle damage repair efforts have also identified a need for improved leadership and oversight. For example:

- The Navy's *Operational Logistics in a Contested Maritime Environment* concept published in 2017 identifies actions needed to improve command and control for logistics, including that the Navy needs to establish a maritime theater logistics commander.
- The Logistics Warfare Improvement Program recommended in the June 2019 integrated prioritized capabilities list that the Navy establish a Naval Logistics Enterprise that would improve collaboration to ensure logistics are responsive and relevant to warfighting missions.<sup>23</sup> In January 2021, the Chief of Naval Operations released the *Transforming Naval Logistics for a Great Power Competition* strategy, which calls for the creation of a Naval Logistics Enterprise that would, among other things, support the Logistics Warfare Improvement Program.<sup>24</sup>
- A Navy salvage team participating in a June 2020 battle damage repair exercise concluded that the command and control structure for battle damage repair needed to be formalized and practiced.

In February 2020, the Office of the Chief of Naval Operations for Fleet Readiness and Logistics (OPNAV N4) established a Repair Cross Functional Team to bring together battle damage repair efforts across the Navy. Rather than leading and overseeing efforts to assess and develop battle damage repair capability, the Repair Cross Functional Team focuses on ensuring that all Navy battle damage repair planners are aware of their respective efforts. OPNAV N4 officials stated that their coordination is limited without the ability to invest in battle damage repair efforts. For example, OPNAV N4 officials stated that, even if they were able to identify the need for a critical battle damage repair investment, they do not have the authority to require organizations affected by

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<sup>23</sup>The Logistics Warfare Improvement Program, known as LOGWIP, provides a venue for stakeholders to identify Naval logistics capability and capacity gaps to inform Navy's planning and programming process. LOGWIP produces an integrated prioritized capabilities list—as do many other sectors of Navy operations—to inform the Navy's annual budgeting process.

<sup>24</sup>CNO, *Transforming Naval Logistics*.

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identified repair investments to fund them. According to the Chief of Naval Operations, *Transforming Naval Logistics* strategy, the Navy should formally establish the structure, governance, and authorities to provide a single voice for naval logistics and a mechanism for strategic coordination among logistics stakeholders. Additionally, according to *Standards for Internal Control in the Federal Government*, management should establish an organizational structure, assign responsibility, and delegate authority to achieve the entity's objectives.<sup>25</sup> Without clearly designating an organization with the appropriate authority responsible for leading and overseeing the Navy's efforts to assess and develop its battle damage repair capability, the Navy may not fully address challenges or make necessary battle damage repair investments to ensure it can sustain its ships during conflict with a great power competitor.

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### The Navy Does Not Have Guidance on Execution of Battle Damage Repair during a Great Power Conflict

The Navy also does not have guidance that describes the command and control responsibilities for executing battle damage repair during a great power conflict. Within the Navy, organizations are aware of the importance of developing an organizational structure to provide command and control for battle damage repair. For example, according to the Navy's *Operational Logistics in a Contested Maritime Environment* concept, the Navy should develop guidance to define relationships for efforts like battle damage repair to enable timely, coordinated maritime logistical capabilities and operational support to the warfighter. In addition, the U.S. Pacific Fleet's April 2020 *Mobile Logistics Campaign Plan* identified actions and established milestones needed for the fleet to achieve initial and full transition to mobile logistics operations, including development of repair capabilities. However, this effort applies only to the U.S. Pacific Fleet, and does not address command and control issues outside of their area of responsibility.

Command and control guidance is important because the Navy's battle damage repair capability differs from its current salvage and repair capabilities in several respects. For example, a battle damage repair response in a great power conflict would likely not have access to the same resources—such as ports, materials, and time—as a salvage event conducted during peacetime. In addition, regular maintenance is not generally performed in response to an urgent need for the damaged ship

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<sup>25</sup>[GAO-14-704G](#).

to redeploy to the battle, which may drive decisions that would not normally arise—such as identifying safe locations to conduct repairs, applying more streamlined maintenance standards, or conducting partial repairs.

Navy officials we spoke with generally noted a lack of clarity in the decision-making process, such as who within the chain of command decides whether to rearm or repair a damaged ship. Currently, three organizations coordinate the Navy's salvage efforts. However, according to Navy officials, a battle damage repair response would include additional input from a fourth organization—the fleet in command of the ship—that could complicate decision-making and repair efforts during a conflict. During a conflict scenario, the need to quickly weigh warfighting needs and triage multiple, near-simultaneous repairs could challenge existing decision-making processes that involve multiple stakeholders. In addition, in June 2020, a battle damage repair exercise concluded that a command structure needed to be formalized and practiced.

The Navy does not have guidance that identifies command and control responsibilities for executing battle damage repair during conflict with a great power competitor because it has not designated an organization to develop and issue this guidance. Absent guidance, in the event of a great power conflict with damage potentially occurring to multiple ships near simultaneously, officials have stated that the Navy would likely need to issue ad hoc guidance to its organizations to guide battle damage repair decisions. The potential need for such ad hoc guidance may not be consistent with warfighting needs for timely repairs. For example, Navy officials we interviewed generally agreed that the Navy could handle a single battle damage event, but were uncertain how the Navy might handle multiple simultaneous or near-simultaneous events.

According to Navy officials, guidance to inform command and control responsibilities for executing battle damage repair would be helpful. OPNAV N4 officials told us that the factors surrounding battle damage repair were to be examined during a logistics-centered war game that was delayed and ultimately cancelled as a result of Coronavirus Disease 2019 restrictions.<sup>26</sup> By designating an organization to develop and issue guidance that clarifies command and control responsibilities for executing

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<sup>26</sup>The Office of the Chief of Naval Operations for Fleet Readiness and Logistics (OPNAV N4) conducted a battle damage repair-specific war game in May 2021, however the after-action report summarizing the war game results was not completed prior to issuing this report.

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battle damage repair, the Navy will be better positioned to execute effective and timely battle damage repair in the event of a great power conflict. In addition, it will also assist the Navy's efforts to assess and develop solutions to its battle damage repair challenges across the planning considerations, particularly those involving organization, training, and leadership, by helping to identify key stakeholders and decision makers.

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## The Navy Does Not Have Quality Data to Inform Its Efforts to Analyze Battle Damage Repair Needs

In accordance with statute, DOD instruction, and Navy instruction, the Navy creates computer-based vulnerability models during acquisition of a new ship class design to perform realistic survivability testing—simulating enemy weapons' impact on the ship and the likelihood of the ship to continue mission-critical functions after a hit—and ensure the Navy's surface ships have a basic level of survivability.<sup>27</sup> To assess survivability, the Naval Surface Warfare Center, Carderock Division (NSWC-CD) creates vulnerability models for each class of ship that measure a ship's ability to withstand initial damage effects from weapons and continue to perform its primary warfighting mission. Depending on the severity of damage, vulnerability models can predict the degree to which a ship will be able to continue to perform its primary mission, exit the battle area under its own power, and conduct an orderly evacuation. According to NSWC-CD officials, the Navy has developed ship vulnerability models for two aircraft carrier platforms, eight amphibious platforms, three combatant platforms, four littoral combat ship platforms, four Military Sealift Command platforms, and the frigate FFG(X) program.<sup>28</sup>

In recent years, Navy planners have expanded the use of these ship vulnerability models to support war games that explore battle damage

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<sup>27</sup>10 U.S.C. §2366; DOD Instruction 5000.89, *Test and Evaluation* (Nov. 19, 2020); Chief of Naval Operations Instruction 9070.1B, *Survivability Policy and Standards for Surface Ships and Craft of the U.S. Navy* (Nov. 17, 2017).

<sup>28</sup>The specific platforms are as follows: USS *George Washington* (CVN-73); USS *Gerald R. Ford* (CVN-78); USS *San Antonio* (LPD-17); USS *Bataan* (LHD-5); USS *Makin Island* (LHD-8); USS *America* (LHA-6); *Landing Craft Air Cushion* (LCAC); *Ship to Shore Connector* (SSC); *Landing Craft Utility* (LCU); USS *Harpers Ferry* (LSD-49); USS *Oscar Austin* (DDG-79); USS *Bunker Hill* (CG-52); USS *Zumwalt* (DDG-1000); USS *Freedom* (LCS-1); USS *Independence* (LCS-2); USS *Fort Worth* (LCS-3); USS *Coronado* (LCS-4); USNS *Lewis and Clark* (T-AKE-1); USNS *John Lewis* (T-AO-205); *Expeditionary Fast Transport* (T-EPF); *Afloat Forward Staging Base* (AFSB); and Frigate FFG(X) program.

repair capability options. Navy planners find ship vulnerability models useful during these war games to estimate the extent of damage the Navy might expect during conflict with a great power competitor, which allows them to determine the most likely types of repairs needed in response to the damage. The vulnerability models allow for improved decision-making and logistics planning during exercises and future resource planning efforts. These models can also inform residual mission capabilities and mission-critical vulnerabilities after taking on damage from a great power competitor. According to Navy officials, ship vulnerability models also may inform decisions during an actual battle damage repair event, such as the expertise that might be needed to support repairs of a specific ship. These models can also inform fleet commanders on the likelihood a ship will be able to operate on its own power after a hit or may require logistical assistance such as towing or salvage.

However, according to Navy officials, using existing ship vulnerability models to inform battle damage repair efforts presents a number of challenges.

**Modifications.** Ship vulnerability models reflect the initial design of the ship as it was delivered and become dated as alterations are made over a ship's decades-long service life. Navy officials note that any changes to mission-critical systems—such as the location of communications, radar, or combat systems—during a maintenance period, major modernization, or other modification are not reflected in these models. For example, we previously reported the amphibious assault ship USS America (LHA-6) was delivered to the fleet in March 2016 with deficiencies in a system used for refueling at sea and an electronic warfare system.<sup>29</sup> As a result, in 2018 the USS America underwent hull, mechanical, and electrical repairs in addition to modifications to the flight deck to support F-35 Lightning II operations— enabling these aircraft to conduct short takeoffs and vertical landings. Navy officials told us that these significant changes to the ship are not reflected in the

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<sup>29</sup>GAO, *Navy Shipbuilding: Policy Changes Needed to Improve Post-Delivery Process and Ship Quality*, [GAO-17-418](#) (Washington, D.C.: July 13, 2017).

ship's vulnerability model.<sup>30</sup> As a result, war games performed to refine operational concepts for battle damage repair and train senior leaders are using outdated ship vulnerability models that may not accurately reflect a ship's ability to maintain mission-critical functions after receiving damage against a great power competitor which could adversely impact efforts to refine concepts.

**Applicability.** According to officials, ship vulnerability models reflect the first ship within a class, and do not reflect subsequent design adjustments within the class. For acquisition purposes, small adjustments to subsequent ships in a class may not impact the ship's overall survivability, however design adjustments can affect the model's ability to accurately predict battle damage repair impact on mission-critical functions when used to inform battle damage repair efforts. For example, NSWC-CD produced a ship vulnerability model for the USS *Gerald R. Ford* (CVN-78)—the first aircraft carrier in the *Ford* class. However, challenges in maturing this aircraft carrier's critical technologies have led to the redesign or replacement of some key systems.<sup>31</sup> As a result, the ship vulnerability model developed to reflect the USS *Gerald R. Ford* will not accurately predict battle damage repair impact on improved critical systems on subsequent ships in the *Ford* class.

**Fidelity.** Ship vulnerability models vary in the level of detail or overall fidelity of information. According to NSWC-CD officials, the level of detail of a ship vulnerability model is determined by a number of factors, such as the computing power at the time the ship was acquired, the weapons effects of interest given the ship's intended mission, and the resources available to the program office acquiring the ship. For example, the USS *Harper's Ferry* (LSD-49) amphibious platform was delivered to the fleet in 1994

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<sup>30</sup>While ship vulnerability models are not updated after acquisition, Navy officials said there are mechanisms in place to ensure the ship maintains survivability standards throughout the ship's service life. Once an acquired ship is delivered to the fleet, Navy maintenance manuals and general specifications for overhaul require that capability requirements are not degraded throughout the life cycle of a ship, such as during a major modernization or repair.

<sup>31</sup>GAO, *Defense Acquisitions Annual Assessment: Drive to Deliver Capabilities Faster Increases Importance of Program Knowledge and Consistent Data for Oversight*, [GAO-20-439](#) (Washington, D.C.: June 3, 2020). We reported that the Navy is struggling to demonstrate the reliability of key systems on the USS *Gerald R. Ford* (CVN-78), including the aircraft launch system and radar system.

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and its vulnerability model reflects the level of fidelity produced by the computing power available at the time. As a result, this ship's vulnerability model may not reflect the level of detail that is available in a model produced today, and may not reflect accurate results when used to support a war game to inform battle damage repair efforts.

In support of the National Defense Strategy, the Secretary of Defense established 10 targeted goals—one of which is to establish realistic joint war games, exercises, and training plans. According to *Standards for Internal Control in the Federal Government*, organizations should obtain and process quality information that supports their needs.<sup>32</sup> The Navy expanded its use of ship vulnerability models originally designed to inform acquisition decisions to inform battle damage repair efforts even though in some instances models are inaccurate. According to NSWC-CD officials, these models are inaccurate because the Navy does not require in its guidance periodic assessments of ship vulnerability model accuracy to ensure the models reflect mission-critical systems and inform battle damage repair planning efforts. Rather, portions of ship vulnerability models are only updated if a fleet requests an update and the related program office provides funding for the update. NSWC-CD officials agreed that vulnerability models would need to be periodically assessed and comprehensively updated to conduct accurate battle damage repair analysis that is consistent with state-of-the-art modeling capability and reflect improvements made after major ship overhauls.

Without the Navy establishing guidance that requires it to periodically assess and update, as appropriate, ship vulnerability models to ensure the models reflect the ship's mission-critical systems, these models may not accurately inform efforts to assess and develop battle damage repair capabilities and the Navy may not be adequately prepared for conflict during great power competition.

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## Conclusions

The Navy has not had to conduct battle damage repair on multiple ships concurrently since World War II. In recent years, the rise of great power competitors with capable, precision weapons revives pressure on the Navy to develop a battle damage repair capability for potential conflict.

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<sup>32</sup>[GAO-14-704G](#)

Developing such a capability is a complex undertaking, requiring multiple stakeholders to reassess and address any gaps in the Navy's regular maintenance capability, with implications for doctrine, organizations, training, materiel support, leadership, personnel, and facilities.

The Navy has begun taking steps to develop the battle damage repair capabilities it would need and update its requirements to reflect the demands of a great power conflict. However, the Navy has not designated an organization with the appropriate authority to lead and oversee efforts to assess and develop battle damage repair capability to ensure these efforts are coordinated, avoid gaps and overlapping efforts, and collectively produce the capability the Navy needs. The Navy also has not designated an organization to develop and issue guidance clarifying the command and control responsibilities for executing battle damage repairs during an actual conflict. Designating a lead organization to guide the current disparate efforts to develop battle damage repair capabilities and clarify command and control responsibilities during a conflict will better position the Navy to address this complex problem and effectively execute battle damage repair during a time of conflict, when time would be of the essence.

The Navy has also used ship vulnerability models during logistical war games to estimate the damage to be expected during conflict with a great power competitor and to help refine operational concepts and train leaders on key decision-making tasks. However, the Navy has not established guidance that requires the Navy to periodically assess and update, as appropriate, its ship vulnerability models to reflect modifications made to a ship's mission-critical systems after acquisition. Assessing and updating ship vulnerability models periodically to ensure they accurately reflect the ship's mission-critical systems will help inform battle damage repair planning efforts and better prepare the Navy to sustain operations during a great power conflict.

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## Recommendations for Executive Action

We are making the following three recommendations to the Secretary of the Navy:

The Secretary of the Navy should designate an organization with the appropriate authority to lead and oversee development of the Navy's battle damage repair capability. (Recommendation 1)

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The Secretary of the Navy should designate an organization to develop and issue guidance that clarifies command and control responsibilities for executing battle damage repair. (Recommendation 2)

The Secretary of the Navy should establish guidance that requires the Navy to periodically assess and update, as appropriate, ship vulnerability models to ensure these models accurately reflect the ship's mission-critical systems and inform battle damage repair planning efforts. (Recommendation 3)

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## Agency Comments

We provided a draft of this report to DOD for review and comment. In its written responses to our recommendations, reproduced in appendix III, the Navy partially concurred with all three recommendations.

The Navy partially concurred with our first recommendation to designate an organization with the appropriate authority to lead and oversee development of the Navy's battle damage repair capability. In its written comments, the Navy stated that NAVSEA is the organization with the authority to lead and oversee development of the Navy's battle damage repair capability. The Navy also stated that NAVSEA is not officially designated via instruction or formal designation to perform these roles. We continue to believe the Navy should formally designate an organization to lead and oversee development of the Navy's battle damage repair capability. As discussed earlier in this report, several battle damage repair efforts—such as the Logistics Warfare Improvement Program and a June 2020 war game—identified a need for improved leadership and oversight. In addition, the Chief of Naval Operations strategy, *Transforming Naval Logistics for Great Power Competition—signed in January 2021*—directs the Navy to formally establish the structure, governance, and authorities to provide a single voice for Naval logistics—which includes battle damage repair—and a mechanism for strategic coordination among logistics stakeholders.

Similarly, the Navy partially concurred with our second recommendation to designate an organization to develop and issue guidance that clarifies command and control responsibilities for executing battle damage repair. In its written comments, the Navy stated that NAVSEA is the organization with command and control responsibilities for executing battle damage repair, but is not officially designated via instruction or formal designation to perform these roles. We continue to believe the Navy should formally

designate an organization to develop and issue clarification of such command and control responsibilities. As discussed earlier in the report, Navy officials we spoke with generally noted a lack of clarity in the decision-making process--such as who within the chain of command decides whether to rearm or repair a damaged ship--and that the Navy would likely need to issue ad hoc guidance to its organizations to guide battle damage repair decisions. The potential need for such ad hoc guidance may not be consistent with warfighting needs for timely repairs. For example, Navy officials we interviewed generally agreed that the Navy could handle a single battle damage event, but were uncertain how the Navy might handle multiple simultaneous or near-simultaneous events. Having formal designations of responsibilities in place prior to conflict would enhance the Navy's ability to effectively execute battle damage repair during conflict, when time would be of the essence.

The Navy partially concurred with our third recommendation to establish guidance that requires the Navy to periodically assess and update, as appropriate, ship vulnerability models to inform battle damage repair planning efforts. In its written comments, the Navy stated that it updates ship vulnerability models in support of specific efforts--such as war games or certain modernization efforts--and that NAVSEA subject matter experts will help determine how frequently such updates occur in the future. However, as discussed earlier in the report, ship vulnerability models may become outdated as a ship-class design evolves after the first ship in the class, ships undergo modifications after acquisition, or adversary threats evolve. In addition, older models may have limited utility as they reflect the level of detail that was technologically achievable at the time the ship was acquired. The Navy updates ship vulnerability models when requested and funded by a fleet, and often these updates reflect only a portion of the model rather than the complete model. We agree with the Navy's commitment to updating ship vulnerability models. However, we continue to believe the frequency and factors requiring those updates should be established in guidance, to ensure the Navy is systematically updating models after it acquires ships.

The Navy also provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Defense, and the Acting Secretary of the Navy. In addition, the report is available at no charge on the GAO website at <https://www.gao.gov>.

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If you or your staff have questions about this report, please contact me at [maurerd@gao.gov](mailto:maurerd@gao.gov) or (202) 512-9627. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page

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of this report. GAO staff who made key contributions to this report are listed in appendix IV.

A handwritten signature in black ink that reads "Diana Maurer". The signature is written in a cursive style with a large, stylized 'D' and 'M'.

Diana Maurer  
Director, Defense Capabilities and Management

---

*List of Committees*

The Honorable Jack Reed  
Chairman  
The Honorable James M. Inhofe  
Ranking Member  
Committee on Armed Services  
United States Senate

The Honorable Jon Tester  
Chairman  
The Honorable Richard Shelby  
Ranking Member  
Subcommittee on Defense  
Committee on Appropriations  
United States Senate

The Honorable Adam Smith  
Chairman  
The Honorable Mike Rogers  
Ranking Member  
Committee on Armed Services  
House of Representatives

The Honorable Betty McCollum  
Chair  
The Honorable Ken Calvert  
Ranking Member  
Subcommittee on Defense  
Committee on Appropriations  
House of Representatives

# Appendix I: Contacted Organizations

See table 4 for the organizations within the Department of the Navy that we interviewed or obtained documentation from during the course of our audit.

**Table 4: Organizations Contacted by GAO**

Lead organization	Subordinate organizations
Assistant Secretary of the Navy for Research, Development and Acquisition	<ul style="list-style-type: none"> <li>Deputy Assistant Secretary of the Navy-Ships</li> <li>Wartime Acquisition Support Plan (WASP) coordinating cell</li> </ul>
Military Sealift Command	--
Naval Sea Systems Command (NAVSEA)	<ul style="list-style-type: none"> <li>Logistics, Maintenance and Industrial Operations</li> <li>Surface Ship Maintenance and Modernization</li> <li>The Naval Systems Engineering &amp; Logistics Directorate, Technology Office (05T)</li> <li>Office of the Director of Ocean Engineering, Supervisor of Salvage and Diving (SUPSALV)</li> <li>Naval Surface Warfare Center – Carderock Division</li> <li>Mid-Atlantic Regional Maintenance Center (MARMC)</li> </ul>
Office of the Chief of Naval Operations (OPNAV)	<ul style="list-style-type: none"> <li>Warfare Integration (N9I)</li> <li>Assessment Division (N81)</li> <li>Fleet Readiness (N83)</li> <li>Fleet Readiness and Logistics (N4)</li> </ul>
U.S. Fleet Forces Command	<ul style="list-style-type: none"> <li>Navy Warfare Development Command</li> <li>Naval Expeditionary Combat Command</li> </ul>
U.S. Naval War College	<ul style="list-style-type: none"> <li>Wargaming Department</li> <li>College of Maritime Operational Warfare</li> </ul>
U.S. Navy Installations Command	<ul style="list-style-type: none"> <li>Office of the Commander</li> </ul>
U.S. Pacific Fleet	<ul style="list-style-type: none"> <li>Office of the Commander, Submarine Force</li> <li>Office of the Commander, Fleet Maintenance (N43)</li> </ul>

Source: GAO. | GAO-21-246

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## Appendix II: Battle Damage Repair: Challenges and Efforts

When a military service requires new or additional capabilities not associated with a new defense acquisition program, it can assess its capability gap through DOD's planning considerations framework. This framework—which considers the effect of a new capability on doctrine, organization, training, materiel, leadership, personnel, and facilities—is intended to ensure that a military service has considered existing resources before turning to acquisition to solve a given problem. This appendix provides detailed information on the Navy's challenges within each planning consideration and efforts undertaken by various Navy organizations to improve battle damage repair.

## Planning Consideration: Doctrine

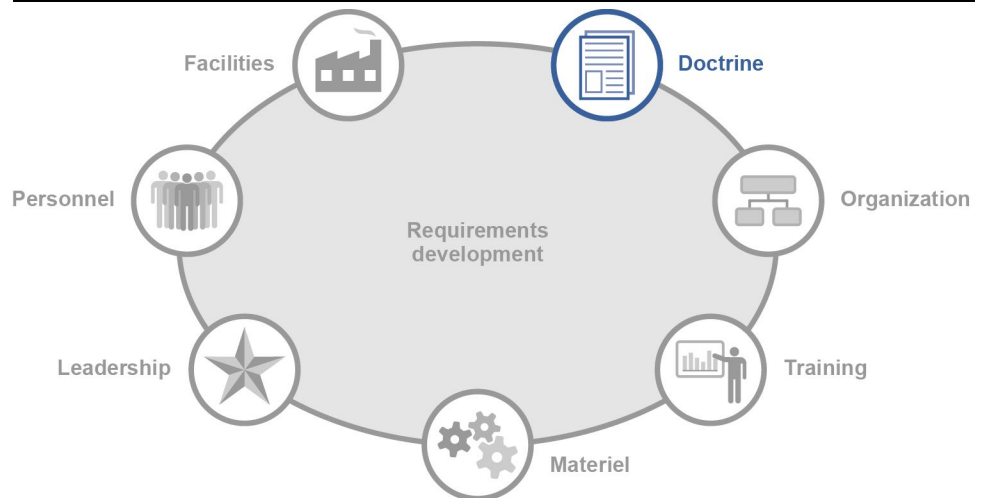
In DOD's Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) planning considerations framework, doctrine may refer to any of the following:

- Concepts
- Field manuals
- Tactics
- Techniques
- Procedures
- Regulations
- Directives
- Instructions
- Policies

Doctrine describes how an organization plans to address a given problem.

View [GAO-21-246](#). For more information, contact Diana Maurer at (202) 512-9627 or [maurerd@gao.gov](mailto:maurerd@gao.gov)

## Battle Damage Repair: Challenges and Efforts



Source: Chairman of the Joint Chiefs of Staff Instruction 3010.02E, *Guidance for Developing and Implementing Joint Concepts* (August 17, 2016). | GAO-21-246

## Navy-Identified Challenge

- **Lack of established doctrine for battle damage repair.** The Navy does not have updated doctrine, tactics, techniques, and procedures that reflect the demands for battle damage repair during a great power conflict. In part, this is because the Navy has not needed to do such repairs at scale during a conflict in decades.

## Navy Efforts

1. **Operational Logistics in a Contested Maritime Environment concept.** The U.S. Navy issued this concept in July 2017. The concept acknowledges that the U.S. Navy will likely suffer increased damage against a great power competitor, require expedient, partial repairs to ensure a damaged ship can continue mission-critical capability, and manage repairs within a contested environment – all of which drive demand for expeditionary afloat and ashore repair capabilities.
2. **Ship Wartime Repair and Maintenance concept.** U.S. Pacific Fleet began developing this concept in 2019 and finalized the concept in April 2021. Its goal is to operationalize some of the requirements outlined in the *Mobile Logistics Campaign Plan*, including those for in-theater support to provide mobile repair with the goal of restoring warfighting capability as quickly as possible.
3. **Expeditionary At-Sea Repair concept.** This concept was initiated in 2019 by U.S. Fleet Forces Command and is still being developed. Its goal is to describe the process in the Atlantic Fleet should ships need repairs while forward deployed at sea. According to Fleet Forces officials, the concept will not be ready until around fiscal year 2022 at the earliest.
4. **Expeditionary Port Damage Repair concept.** Expeditionary Warfighting Development Command began creating this concept in 2018, with the intent to outline how the Navy would repair damaged ports and identify who would be responsible for making these repairs.

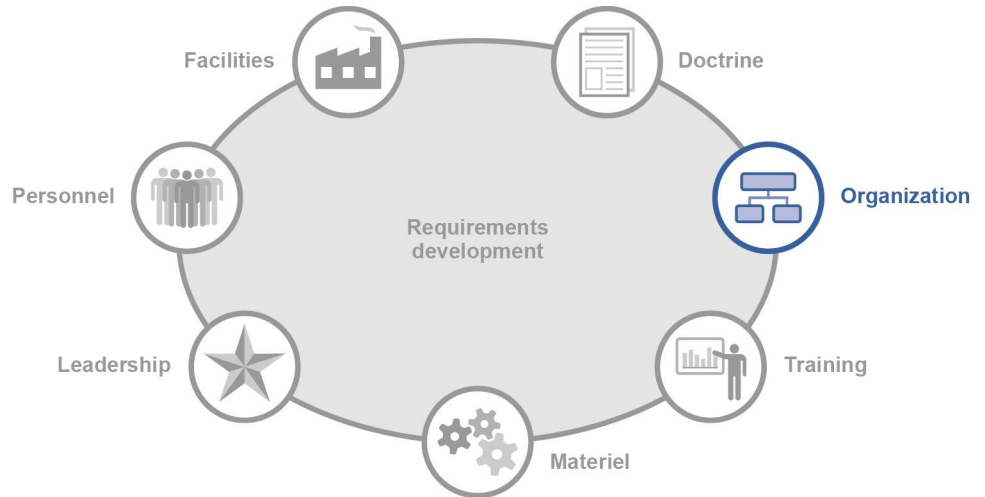
## Planning Consideration: Organization

In DOD's Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) planning considerations framework, organization may refer to any of the following:

- Force structure
- Organizational charts
- Organizational equipment list

Organization reflects how the Navy will structure and organize its units to address a given problem.

## Battle Damage Repair: Challenges and Efforts



Source: Chairman of the Joint Chiefs of Staff Instruction 3010.02E, *Guidance for Developing and Implementing Joint Concepts* (August 17, 2016). | GAO-21-246

## Navy-Identified Challenge

- **Lack of clear roles and responsibilities.** Multiple organizations from the Navy's regular maintenance functions, salvage community, and the fleets have responsibilities within the battle damage repair process, and the roles and responsibilities for assessing, developing, and conducting battle damage repair are not always clear.

## Navy Efforts

5. **Salvage Executive Steering Committee.** The Salvage Executive Steering Committee is a Navy working group consisting of salvage triad members that meets regularly to discuss salvage-related issues and planning efforts. It meets annually, and battle damage repair was discussed during the working group's November 2020 meeting.
6. **Repair Cross-Functional Team.** In January 2021, the Chief of Naval Operations issued the *Transforming Naval Logistics for a Great Power Competition*—an overarching logistics support concept that outlines elements of transformation required to sustain Naval forces during great power competition. In support of this concept, Navy officials from the repair sector of The Office of the Chief of Naval Operations, Fleet Readiness and Logistics (OPNAV N4) host quarterly meetings so that multiple repair and maintenance stakeholders across the Navy can share their planning efforts.
7. **Surface Team 1 Working Group.** This working group was started in January 2020 and is led by the Commander of the Navy Regional Maintenance Centers. It includes maintenance team experts across the Navy from the fleet maintenance directors, Navy regional maintenance centers, Naval Sea Systems Command for Surface Ship Maintenance and Modernization, and Naval Sea Systems Command for Industrial Operations. They discuss concerns pertaining to the surface fleet, including battle damage repair.

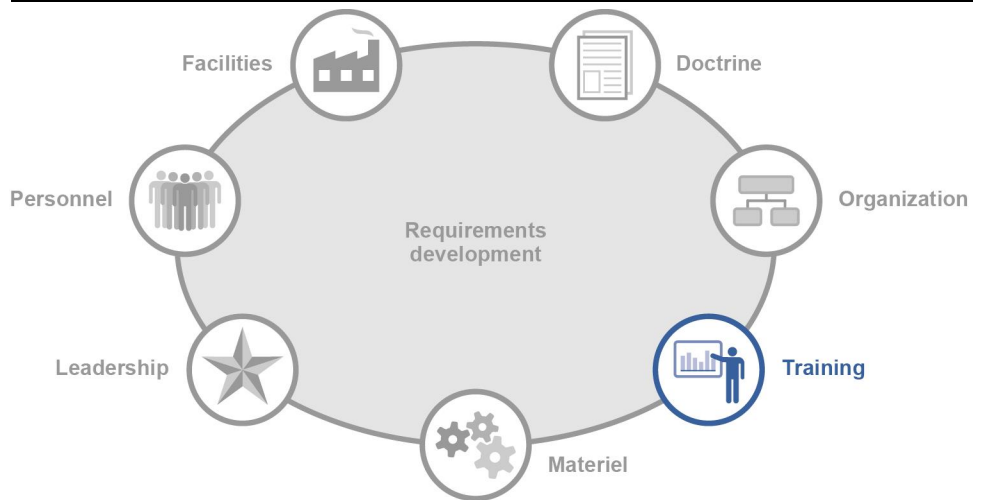
## Planning Consideration: Training

In DOD's Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) planning considerations framework, training may refer to any of the following kinds of education:

- Individual
- Unit
- Basic
- Specialized

Training is how an organization will teach its personnel to address a given problem.

## Battle Damage Repair: Challenges and Efforts



Source: Chairman of the Joint Chiefs of Staff Instruction 3010.02E, *Guidance for Developing and Implementing Joint Concepts* (August 17, 2016). | GAO-21-246

## Navy-Identified Challenges

- **Reliance on maintenance contractors.** Complex maintenance of non-nuclear ships are generally contracted to private shipyards. As a result, sailors may not be adequately trained to conduct certain repairs that might be necessary if a ship is damaged during conflict. For example, Navy officials noted that training often focuses on the replacement of damaged parts, rather than repairing those parts. While replacement may be an appropriate solution in an environment where parts are readily available, it might be problematic in a contested environment with vulnerable supply lines where time is of the essence.
- **Lack of logistics-focused war games.** Navy War College officials stated that fleets generally do not evaluate logistical support in war games used to simulate and refine operational approaches. This makes it difficult to test assumptions for battle damage repair or challenge assumptions concerning available salvage resources.

## Navy Efforts

8. **Navy Afloat Maintenance Training Strategy (NAMTS).** The Navy established the NAMTS certification program for sailors at the Regional Maintenance Centers. The goal is to provide sailors with additional maintenance skills that could be useful during deployment, including during a battle damage scenario.
9. **War games.** The Navy has begun to conduct war games to simulate battle damage response and salvage. The first logistics-focused war game was hosted in 2019, and others have followed. For example, in June 2020 the Mobile Diving and Salvage Units practiced a scenario involving a damaged ship at sea and concluded that a lack of cross-functional expertise and clear roles and responsibilities stressed communications and hampered repair response. Another at-sea repair-focused war game was conducted in May 2021.

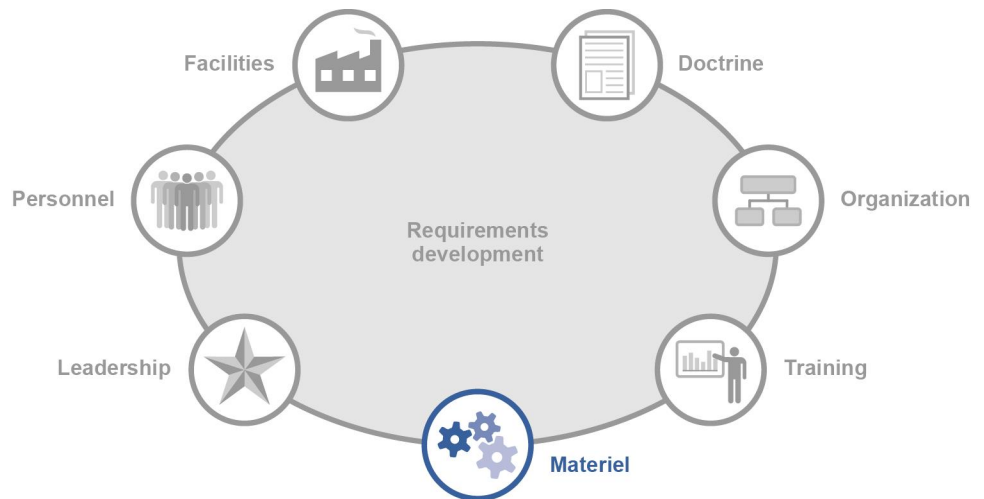
## Planning Consideration: Materiel

In DOD's Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) planning considerations framework, materiel may refer to any of the following:

- Types of maintenance
- Spare parts
- Capital equipment
- Supply services

Materiel refers to the supplies an organization will use to address a given problem.

## Battle Damage Repair: Challenges and Efforts



Source: Chairman of the Joint Chiefs of Staff Instruction 3010.02E, *Guidance for Developing and Implementing Joint Concepts* (August 17, 2016). | GAO-21-246

## Navy-Identified Challenges

- **Reliance on contracted salvage support ships.** The Navy relies on contracts for both salvage ships and repair technicians to supplement the Navy's organic salvage fleet. However, private salvage companies may be unable or unwilling to support battle damage repair efforts during conflict with a great power competitor, due to safety concerns.
- **Parts needed for battle damage repair.** Navy officials have stated that they are not certain the Navy has the right parts and materials ready for a great power competition. While the Navy does have battle spares, officials noted that these are handled by independent program offices and may not reflect the types of damage that could be expected during a great power competition. In addition, the short time frames expected during battle damage repair make the availability and location of parts even more critical.

## Navy Efforts

10. **Navy Engineering Sustainment Technology Team.** The Navy is exploring technological solutions to moving salvage capability forward, such as using autonomous assessment drones and manufacturing replacement parts aboard ships, among others.
11. **Naval Sea Systems Command (NAVSEA) 05T Technology Integration Team.** A group created by NAVSEA Naval Systems Engineering Directorate, Technology office in October 2019, with a goal of developing a number of technologies intended to improve ships' abilities to self-repair. That includes battle damage assessment drones, additive manufacturing, and other technologies.
12. **Logistics Warfare Improvement Program.** A working group created in 2018 and led by Military Sealift Command that develops key investment requests for the logistics community. For example, the working group recommended creating a Naval Logistics Enterprise in 2019 to help coordinate logistics efforts.

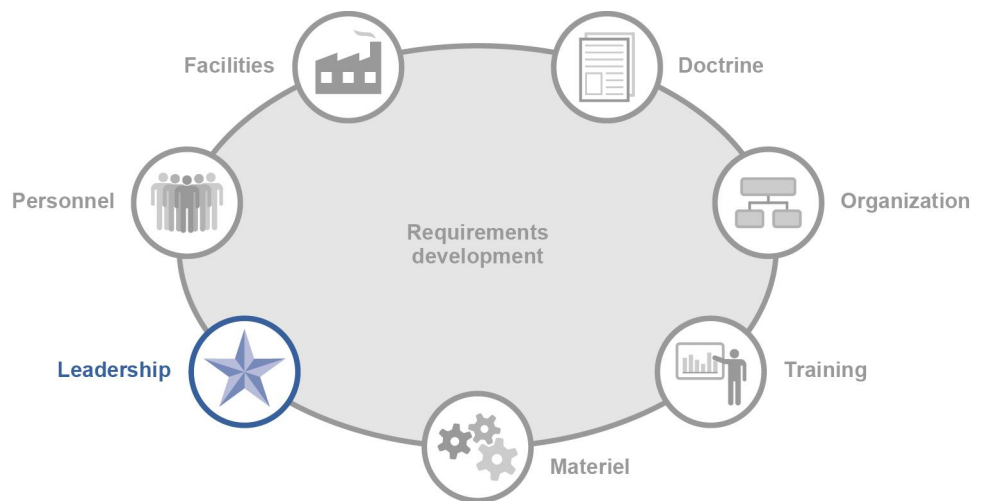
## Planning Consideration: Leadership

In DOD's Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) planning considerations framework, leadership may refer to how an organization prepares its leaders, including:

- Leadership training
- Information
- Leadership policies and procedures

Leadership outlines who is in control—and what is expected of them—as an organization addresses a given problem.

## Battle Damage Repair: Challenges and Efforts



Source: Chairman of the Joint Chiefs of Staff Instruction 3010.02E, *Guidance for Developing and Implementing Joint Concepts* (August 17, 2016). | GAO-21-246

## Navy-Identified Challenge

- *Unclear command and control responsibilities.* The Navy lacks clear command and control responsibilities to execute battle damage repair decisions. For example, Navy officials we spoke with said it is not always clear who would be in control of a given portion of a battle damage repair response. In addition, a June 2020 battle damage repair exercise concluded that the command and control structure for battle damage repairs should be formalized and practiced.

## Navy Effort

13. *Mobile Logistics Campaign Plan.* This plan, released in April 2020 by U.S. Pacific Fleet, outlines a process to develop command and control of logistics forces, which includes repair, within its area of responsibility. It identifies a number of gaps in current capability and assigns responsibility for alleviating those gaps to various Navy organizations, including the specific metrics to improve. By its nature, however, the plan does not address command and control in areas outside of the Pacific.

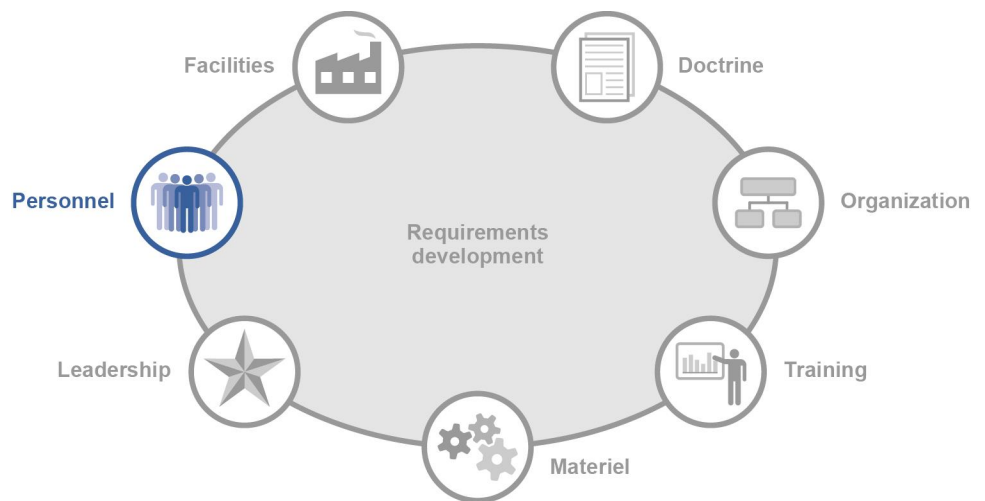
## Planning Consideration: Personnel

In DOD's Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) planning considerations framework, personnel may refer to any of the following:

- Type of personnel
- Number of personnel
- Levels of expertise

Personnel are the individuals with specific skills in an organization who will address a given problem.

## Battle Damage Repair: Challenges and Efforts



Source: Chairman of the Joint Chiefs of Staff Instruction 3010.02E, *Guidance for Developing and Implementing Joint Concepts* (August 17, 2016). | GAO-21-246

## Navy-Identified Challenge

- **Reliance on civilian maintenance experts.** The Navy relies on civilian maintenance personnel stationed in the United States, who may not be willing or able to support battle damage repair overseas. For example, multiple Navy organizations stated a concern that, in the event of a great power conflict, contractors may be unwilling to enter a combat zone, or may be prevented from doing so by their employers.

## Navy Effort

14. **AEGIS Emergent Response Project.** The idea of using a team of experts that can quickly respond to damage events by flying to the location has existed for several years. The Aegis Emergent Response Project, created by Naval Surface Warfare Center—Port Hueneme division in 2017, used this idea in its effort to improve the repairs of Aegis weapon systems. Though that program was ended in 2019, the idea behind it has remained. The Navy's regional maintenance centers and other programs—such as the *Wartime Acquisition Support Plan* (see below)—have pursued additional flyaway teams of experts to support battle damage assessment and repair.

## Planning Consideration: Facilities

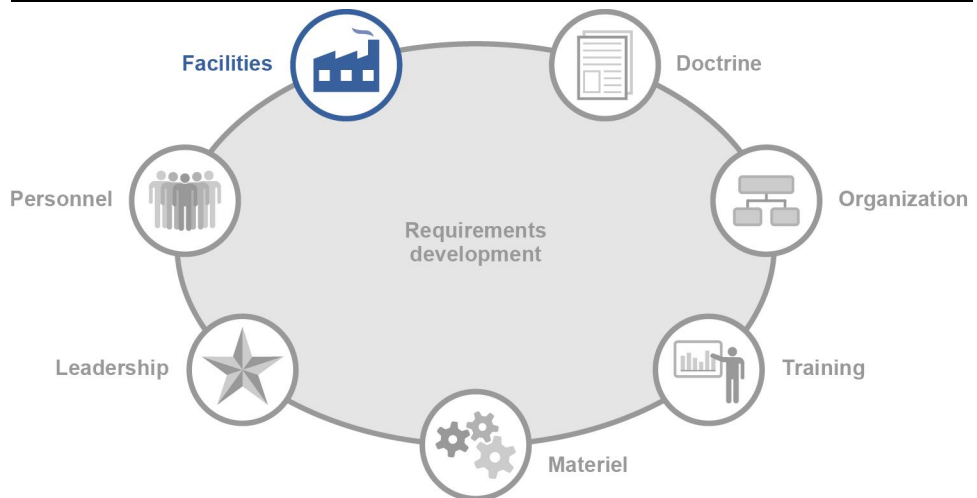
In DOD's Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) planning considerations framework, facilities may refer to any of the following:

- Installations
- Property
- Infrastructure
- Training areas

Facilities are the places where an organization will address a given problem.

View [GAO-21-246](#). For more information, contact Diana Maurer at (202) 512-9627 or [maurerd@gao.gov](mailto:maurerd@gao.gov)

## Battle Damage Repair: Challenges and Efforts



Source: Chairman of the Joint Chiefs of Staff Instruction 3010.02E, *Guidance for Developing and Implementing Joint Concepts* (August 17, 2016). | GAO-21-246

## Navy-Identified Challenges

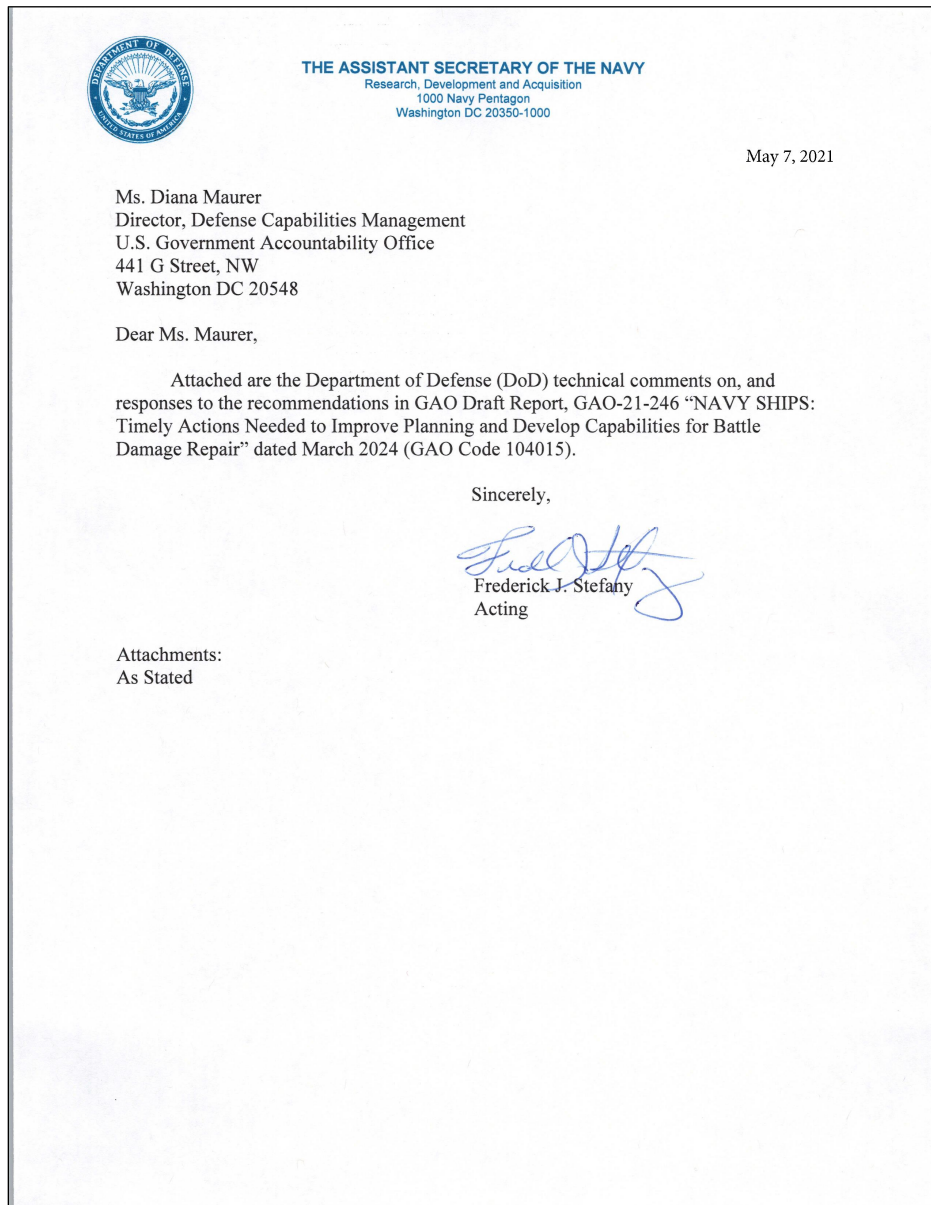
- *Regular maintenance capability is already operating at or above capacity.* The Navy is operating its regular maintenance operations at nearly full capacity and with limited ability to surge to meet sudden needs. Our prior work has shown that the Navy's maintenance process cannot keep up with the Navy's needs during peacetime.<sup>33</sup> Without being able to meet its peacetime demand, the Navy's regular maintenance capability as currently configured and resourced is unlikely to be able to meet any increase in demand that would likely result from battle damage sustained in a great power competition.
- *Unknown or unreliable availability of foreign ports.* Some overseas repair locations—such as foreign ports—may not be viable during great power conflict as areas that are currently safe for repairs come under the threat of attack or want to avoid becoming involved for political reasons.

## Navy Effort

15. *Wartime Acquisition Support Plan (WASP).* An initial effort to improve wartime acquisition started by the Assistant Secretary of the Navy for Research, Defense, and Acquisition in July 2018. It has since branched out into other aspects, such as maintenance. The WASP is evaluating private shipyards and industrial base opportunities to increase surge capacity to repair ships in the United States. It is developing a "shop in a box" concept intended to move shipyard repair capability forward and afloat to support battle damage repairs.

<sup>33</sup>See, for example, GAO, *Navy Maintenance: Persistent and Substantial Ship and Submarine Maintenance Delays Hinder Efforts to Rebuild Readiness*, [GAO-20-257T](#) (Washington, D.C.: Dec. 4, 2019); *Navy Shipyards: Actions Needed to Address the Main Factors Causing Maintenance Delays for Aircraft Carriers and Submarines*, [GAO-20-588](#) (Washington, D.C.: Aug. 20, 2020); and *Naval Shipyards: Actions Needed to Improve Poor Conditions that Affect Operations*, [GAO-17-548](#) (Washington, D.C.: Sept. 12, 2017).

## Appendix III: Comments from the Department of Defense



**GAO DRAFT REPORT**  
**GAO-21-246 (GAO CODE 104015)**  
**"NAVY SHIPS: TIMELY ACTIONS NEEDED TO IMPROVE PLANNING AND**  
**DEVELOP CAPABILITIES FOR BATTLE DAMAGE REPAIR"**  
**DATED MARCH 24, 2021**

**Recommendation 1.** SECNAV should designate an organization with the appropriate authority to lead and oversee development of the Navy's battle damage repair capability.

**Navy Response 1. *Partially Concur.*** Although not officially designated via instruction or formal designation, Naval Sea Systems Command (NAVSEA), in coordination with other stakeholders across the Navy enterprise, is the organization with the authority to lead and oversee development of the Navy's battle damage repair capability and is recognized as such.

**Recommendation 2.** SECNAV should designate an organization to develop and issue guidance that clarifies command and control responsibilities for executing battle damage repair.

**Navy Response 2. *Partially Concur.*** Although not officially designated via instruction or formal designation, Naval Sea Systems Command (NAVSEA), in coordination with other stakeholders across the Navy enterprise, is the organization with command and control responsibilities for executing battle damage repair and is recognized as such.

**Recommendation 3.** SECNAV should establish guidance that requires the Navy to periodically assess and update, as appropriate, ship vulnerability models to ensure these models accurately reflect the ship's mission-critical systems and inform battle damage repair planning efforts.

**Navy Response 3. *Partially Concur.*** Navy updates ship vulnerability models in support of specific efforts such as war-gaming or in support of certain modernization efforts. However, to better support battle damage repair, full ship vulnerability models will need to be maintained at a periodicity determined by NAVSEA subject matter experts such as technical warrant holders.

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## Text of Appendix III: Comments from the Department of Defense

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Page 1

May 7, 2021

Ms. Diana Maurer

Director, Defense Capabilities Management

U.S. Government Accountability Office 441 G Street, NW

Washington DC 20548 Dear Ms. Maurer,

Attached are the Department of Defense (DoD) technical comments on, and responses to the recommendations in GAO Draft Report, GAO-21-246 "NAVY SHIPS: Timely Actions Needed to Improve Planning and Develop Capabilities for Battle Damage Repair" dated March 2024 (GAO Code 104015).

Sincerely,

Frederick J. Stephany

Acting

Attachments:

As Stated

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Page 2

GAO DRAFT REPORT GAO-21-246 (GAO CODE 104015) -- "NAVY SHIPS:  
TIMELY ACTIONS NEEDED TO IMPROVE PLANNING AND DEVELOP  
CAPABILITIES FOR BATTLE DAMAGE REPAIR"

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However, to better support battle damage repair, full ship vulnerability models will need to be maintained at a periodicity determined by NAVSEA subject matter experts such as technical warrant holders.

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## Appendix IV: GAO Contacts and Staff Acknowledgements

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### GAO Contact

Diana Maurer, (202) 512-9627 or [maurerd@gao.gov](mailto:maurerd@gao.gov)

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### Staff Acknowledgements

In addition to the contact named above, Suzanne Wren (Assistant Director), Amy Bush, James Duke, Christopher Gezon, Richard Kusman, James Lackey, Felicia Lopez, Benjamin Moser, Carol Petersen, Michael Silver, Pamela Snedden, Roger Stoltz, and Lillian Moyano Yob made significant contributions to this report.

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